# I-40 EAST CORRIDOR PROFILE STUDY

### I-17 TO ARIZONA/NEW MEXICO BORDER

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**Draft Working Paper 6: Solution Evaluation and Prioritization** 

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# **LIST OF ABBREVIATIONS**

Abbreviation	Name
AADT	Annual Average Daily Traffic
ADOT	Arizona Department of Transportation
BCA	Benefit-Cost Analysis
CCTV	Closed Circuit Television
CS	Candidate Solution
DMS	Dynamic Message Sign
EB	Eastbound
FY	Fiscal Year
I-40	Interstate 40
I-17	Interstate 17
I-19	Interstate 19
I-10	Interstate 10
I-8	Interstate 8
IRI	International Roughness Index
LCCA	Life Cycle Cost Analysis
MP	Milepost
MPD	Multi-Modal Planning Division
OP	Overpass
P2P	Planning to Programming
PES	Performance Effectiveness Score
PTI	Planning Time Index
Rd	Road
RWIS	Roadside Weather Information System

Abbreviation	Name
SR	State Route
TI	Traffic Interchange
TTI	Travel Time Index
TTTI	Truck Travel Time Index
UP	Underpass
US	United States (Route)
WB	Westbound
WIM	Weigh-in-motion



### 1 INTRODUCTION

The Arizona Department of Transportation (ADOT) is the lead agency for this Corridor Profile Study of Interstate 40 (I-40) East between I-17 in Flagstaff and the New Mexico state line. This study will look at key performance measures relative to the I-40 corridor, and the results of this performance evaluation will be used to identify potential strategic improvements.

The intent of the corridor profile program, and of the Planning to Programming (P2P) process, is to conduct performance-based planning to identify areas of need and make the most efficient use of available funding to provide an efficient transportation network. ADOT is conducting eleven corridor profile studies. The eleven corridors are being evaluated within three separate groupings.

The first three studies (Round 1) began in spring 2014, and encompass:

- I-17: SR 101L to I-40
- I-19: Mexico International Border to I-10
- I-40: California State Line to I-17

The second round (Round 2) of studies, initiated in spring 2015, include:

- I-8: California State Line to I-10
- I-40: I-17 to the New Mexico State Line
- SR 95: I-8 to I-40

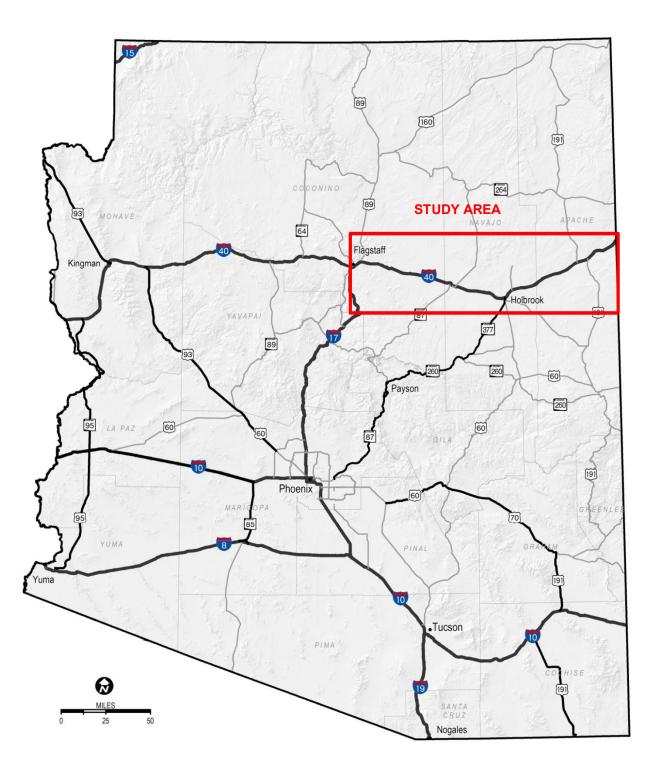
The third round (Round 3) of studies, initiated in fall 2015, include:

- I-10: California State Line to SR 85 and SR 85: I-10 to I-8
- I-10: SR 202L to the New Mexico State Line
- SR 87/SR 260/SR 377: SR 202L to I-40
- US 60/US 70: SR 79 to US 191 and US 191: US 70 to SR 80
- US 60/US 93: Nevada State Line to SR 303L

The studies under this program will assess the overall health, or performance, of the state's strategic highways. The Corridor Profile Studies will identify candidate solutions for consideration in the Multimodal Planning Division's (MPD) P2P project prioritization process, providing information to guide corridor-specific project selection and programming decisions.

I-40, I-17 to New Mexico State Line, depicted in **Figure 1**, is one of the strategic statewide corridors identified and is the subject of this Round 2 Corridor Profile Study.

Figure 1: Corridor Study Area





### 1.1 Corridor Study Purpose

The purpose of the I-40 Corridor Profile Study is to measure corridor performance to inform the development of strategic solutions that are cost-effective and account for potential risks. This purpose can be accomplished by following the process established by the previous Round 1 corridor profile study to:

- Inventory past improvement recommendations.
- Define corridor goals and objectives.
- Assess existing performance based on quantifiable performance measures.
- Propose various solutions to improve corridor performance.
- Identify specific solutions that can provide quantifiable benefits relative to the performance measures.
- Prioritize solutions for future implementation.

### 1.2 Corridor Study Goals and Objectives

The objective of this study is to identify a recommended set of potential strategic solutions for consideration in future construction programs, derived from a transparent, defensible, logical, and replicable process. The I-40 Corridor Profile Study will define solutions and improvements for I-40 that can be evaluated and ranked to determine which investments offer the greatest benefit to the corridor in terms of enhancing performance.

The following goals have been identified as the outcome of this study:

- Link project decision-making and investments on key corridors to strategic goals
- Match solutions with deficiencies in measured performance
- Prioritize improvements that cost-effectively preserve, modernize, and expand transportation infrastructure

### 1.3 Working Paper 6 Overview

The objective of Working Paper #6 is to document the evaluation of the strategic solutions identified for the I-40 Corridor. Pavement and bridge solutions will be evaluated using a Life-Cycle Cost Analysis (LCCA). In addition, this evaluation will include a risk-based performance effectiveness evaluation on each recommendation to determine the amount of benefit to the performance scores each solution produces. The result of this evaluation will be a prioritized list of recommendations for the I-40 corridor.

### 1.4 Corridor Overview

The I-40 corridor is a major east-west transcontinental interstate highway that connects the east coast (North Carolina) to the west coast (California). I-40 is a major transportation artery route for freight as well as passenger vehicular traffic, connecting major metropolitan cities in the south-western United States. I-40 is also the primary transportation route connecting the Phoenix metropolitan area to central and north-eastern parts of the country. I-40, together with I-17, plays a key role in the transportation infrastructure of northern Arizona, contributing to its economic success.

I-40 provides the most direct and fastest link between Flagstaff (and Grand Canyon National Park), central and north-eastern United States to the east, and major Californian Cities to the west (**Figure 1**). I-40 provides a principal road link for freight traffic from the ports in California. This study builds on earlier planning efforts in developing and applying a performance-based process for prioritizing improvements to meet present and future needs in the corridor.

### 1.5 Study Location and Corridor Segments

The I-40 corridor is being studied in two separate Corridor Profile Studies. One study extends from California to I-17 and this study extends from I-17 to New Mexico. For the purposes of this Corridor Profile Study, the portion from I-17 to New Mexico will be referred to as I-40 East.

The I-40 East corridor is 164 miles long, from I-17 (MP 196.0) to Arizona/New Mexico State Line (MP 360.0). The corridor has been divided into 12 distinct segments based on regionally significant intersecting routes, changes in topography, or natural or man-made landmarks along the corridor. The shortest segment is four miles long and the longest, a little over twenty-two miles. Corridor Segments have been described in **Table 1** below, and shown on a map in **Figure 2**.

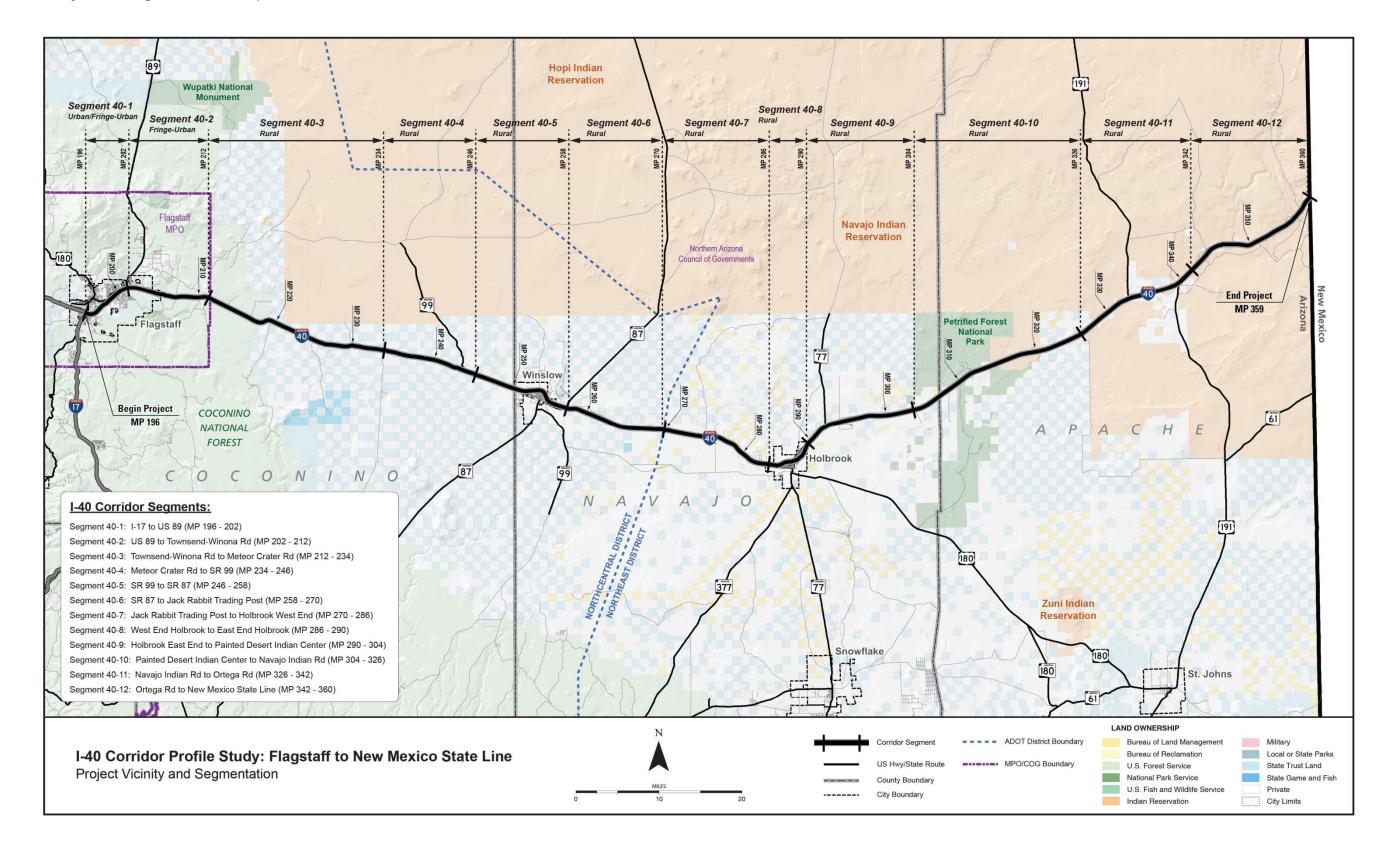


**Table 1: Corridor Segments and Descriptions** 

Segment #	Segment Description	Begin MP	End MP	Length (Miles)	Thru Lanes	2014 AADT (vpd)	Character Description
40-1	I-17 to US 89	196	202	6	4	37,684	This segment is generally urban/fringe-urban in nature, includes three interchanges, and is within the urbanized limits of the Flagstaff Metropolitan Area in Coconino County.
40-2	US 89 to Townsend-Winona Road	202	212	10	4	19,257	This segment is urban-fringe in nature, includes three interchanges, and is within Coconino County.
40-3	Townsend-Winona Road to Meteor Crater Road	212	234	22	4	15,468	This segment is generally rural in nature, includes four interchanges, and is within Coconino County.
40-4	Meteor Crater Road to SR 99	234	246	12	4	15,067	This segment is rural in nature, includes two interchanges, and within Coconino County.
40-5	SR 99 to SR 87	246	258	12	4	15,422	This segment is rural in nature, includes four interchanges, and spans Coconino and Navajo Counties. This segment passes through Winslow.
40-6	SR 87 to Jack Rabbit Trading Post	258	270	12	4	14,604	This segment is rural in nature, includes two interchanges, and is located within Navajo County.
40-7	Jack Rabbit Trading Post to Holbrook West End	270	286	16	4	14,916	This segment is rural in nature, includes four interchanges, and is located within Navajo County.
40-8	Holbrook West End to Holbrook East End	286	290	4	4	14,124	This segment is rural in nature, includes three interchanges, and is located within Navajo County. This segment passes through Holbrook.
40-9	Holbrook East End to Painted Desert Indian Center	290	304	14	4	16,674	This segment is rural in nature, includes four interchanges, and is located within Navajo County.
40-10	Painted Desert Indian Center to Navajo Indian Road	304	326	22	4	15,519	This segment is rural in nature, includes three interchanges, and spans Navajo and Apache Counties.
40-11	Navajo Indian Road to Ortega Road	326	342	16	4	14,719	This segment is rural in nature, includes three interchanges, and is located within Apache County.
40-12	Ortega Road to New Mexico State Line	342	360	18	4	15,580	This segment is rural in nature, includes seven interchanges, and is located within Apache County.



Figure 2: Study Area/Segmentation Map





### 2 CANDIDATE SOLUTION EVALUATION PROCESS

Candidate Solutions identified in Working Paper 5 will be evaluated in multiple ways including a Life Cycle Cost (where applicable), Risk Analysis, and a Performance Effectiveness Analysis. The methodology and approach to this analysis is described below. **Figure 3** illustrates the candidate solution evaluation process.

### 2.1 Life Cycle Cost Analysis

All pavement and bridge candidate solutions have multiple options: rehabilitate the area of need, or fully reconstruct the issue area or structure. These options will be evaluated through a life-cycle cost analysis (LCCA) to determine the best approach for each location where a pavement or bridge solution is recommended. The LCCA could eliminate options from further consideration and will identify which options should be carried forward for further evaluation. After the LCCA and BCA, the remaining options will be advanced to the Performance Effectiveness Evaluation.

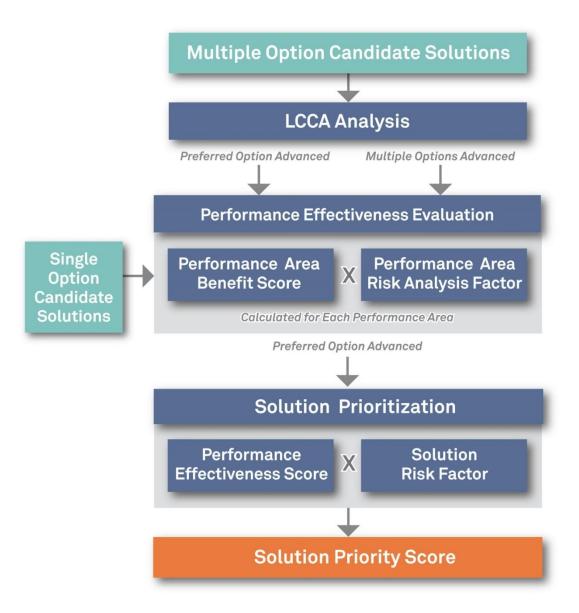
### 2.2 Performance Effectiveness Evaluation

After the LCCA process is complete, all remaining candidate solutions will be evaluated based on their performance effectiveness. This process will include determining a Performance Effectiveness Score (PES) based on how much each solution impacts the existing Performance and Needs scores for each project segment. This process is modeled after a benefit/cost analysis, with the benefits measured in the performance system. This evaluation will also include a Performance Area Risk Evaluation to help differentiate between similar solutions based on factors that are not directly addressed in the performance system.

### 2.3 Risk Analysis

All candidate solutions that are advanced through the Performance Effectiveness Evaluation will also be evaluated through a Risk Analysis process. This process will examine the risk of not implementing a recommended solution in terms of overall corridor performance. The results of this analysis will be combined with the Performance Effectiveness scores to determine the highest priority solutions in the corridor.

**Figure 3: Solution Evaluation Process** 





### 3 CANDIDATE SOLUTION EVALUATION

The principal objective of the corridor profile study is to identify strategic solutions (investments) that are performance-based to ensure that available funding resources are used to maximize the performance of the State's key transportation corridors. The corridor profile process is intended to provide input to the P2P process and will assign strategic solutions to one of the three investment categories: Preservation, Modernization, or Expansion.

The performance system and performance needs previously documented in Working Papers 2 and 4, respectively, served as a foundation for developing strategic solutions for corridor preservation, modernization, and expansion.

Strategic solutions are not intended to recreate or replace results from normal programming processes. However, they should address elevated levels (high or medium) of need and focus on investments in Modernization projects to optimize current infrastructure. Ideally, strategic solutions should address overlapping needs and reduce costly repetitive maintenance. In addition, they should provide a measureable benefit (risk, LCCA, performance system, etc.)

Strategic solutions were derived from previous reports, field reviews, ADOT staff input, observable trends in the performance data, current standards, national and local best practices, and engineering judgement, as documented in Draft Working Paper 5. Table 2 contains the candidate

strategic solutions for the corridor. Cost estimates for each candidate solution are contained in Appendix A.

Following the distribution of Working Paper 5 (Strategic Solutions), candidate solutions were reviewed based on location, solution characteristics, and length. The following considerations were also made:

- Solutions that affect a specific subset of crashes (e.g., lighting, wildlife crossing or fencing) should be separated from other solutions and considered by themselves.
- Solutions that have an elevated crash modification factor (e.g. < 0.50) should be separated from other solutions and considered by themselves (e.g. mainline realignment, parallel entry/exit ramps).
- Solutions should be packaged together by location/geography to the extent possible.

This analysis may have resulted in the combination or modification of the solutions presented in Working Paper 5.



**Table 2: Candidate Solutions** 

Solution #	ВМР	ЕМР	Name	Option*	Scope	Investment Category (P/M/E)
CS40.01	196 EB	196 WB	Lone Tree Road OP EB Bridge	Α	Rehabilitate/repair Lone Tre Rd OP EB bridge	Р
0040.01	190 LB	190 00	Lone free Road OF LB Bridge	В	Replace Lone Tre Rd OP EB bridge	M
CS40.02	196 WB	196 WR	196 WB   Lone Tree Road OP WB Bridge		Rehabilitate/repair Lone Tre Rd OP WB bridge	Р
0040.02	130 110	150 00	Lone free Road Of WB Bridge	В	Replace Lone Tre Rd OP WB bridge	M
CS40.03	196	200	Flagstaff Safety Improvements	-	Enhance delineation (striping, delineators, rumble strips) Install safety edge Rehabilitate/widen inside shoulder Implement variable speed limits (wireless, ground-mount) Install in-lane route pavement markings for WB I-40 at I-17/I-40 Install Roadside Weather Information System (RWIS) Install Closed Circuit Television (CCTV) Camera near existing DMS located at MP 199.6 EB Install rock-fall mitigation near MP 199	M
CS40.04	196	202	Flagstaff Lighting	-	Install lighting	M
CS40.05	198	200	Flagstaff Pedestrian Improvements	-	Install access barrier fence Install grade separated pedestrian crossing	М
CS40.06	198.5	199.5	Butler TI	-	Construct/extend parallel entrance/exit ramps at Butler TI (MP 199)	М
CS40.07	200	207	East Flagstaff Safety Improvements	-	Improve skid resistance (reconstruct pavement, increase super-elevation, or mill and replace) MP 200-202 Install chevrons and curve warning signs MP 200-202 Enhance delineation (striping, delineators, rumble strips) Install safety edge Implement variable speed limits (wireless, ground-mount) Rehabilitate/widen inside shoulder	М
CS40.08	204.5	207.5	Walnut Canyon & Cosnino TI Lighting	-	Install lighting (solar powered LED) at Walnut Canyon TI (MP 205) and Cosnino TI (MP 207)	М
CS40.09	207	212	Winona Safety Improvements	-	Improve skid resistance (reconstruct pavement, increase super-election, or mill and replace) MP 207-208 and MP 210-212 Install chevrons and curve warning signs MP 207-208 and MP 210-212 Enhance delineation (striping, delineators, rumble strips) Install safety edge Rehabilitate/widen inside shoulder Implement variable speed limits (wireless, ground-mount) Install Roadside Weather Information System (RWIS) Install new EB DMS near MP 212.1 with CCTV	М
CS40.10	201.5	205.5	Country Club and Walnut Canyon	-	Construct/extend parallel entrance/exit ramps at Country Club TI (MP 202) and Walnut Canyon TI (MP 205)	М
CS40.11 203 EB 204 EB West of Walnut Canyon Rd A Rehabilitate/repair pavement		Rehabilitate/repair pavement	Р			
00 <del>1</del> 0.11	200 ED	∠U <del>1</del> ⊑D	Pavement	В	Replace pavement	M

<sup>\* &#</sup>x27;-': Indicates only one solution is being proposed and no options are being considered



Solution #	ВМР	ЕМР	Name	Option*	Scope	Investment Category (P/M/E)
CS40.12	218	220	Canyon Diablo West Safety Improvements	-	Improve skid resistance (reconstruct pavement, increase super-elevation, or mill and replace) Install chevrons and curve warning signs Install dynamic speed feedback system near WB MP 220 and EB MP 218 Install safety edge Enhance delineation (striping, delineators, rumble strips) Rehabilitate/widen inside shoulder	М
CS40.13	220	229	Canyon Diablo Safety Improvements	-	Install safety edge Enhance delineation (striping, delineators, rumble strips) Rehabilitate/widen inside shoulder Install Roadside Weather Information System (RWIS) near MP 222-223 Install dynamic wind warning system near MP 222-223	М
CS40.14	219.5	220.5	Twin Arrows TI	-	Construct/extend parallel entrance/exit ramps at Twin Arrows TI (MP 220)	M
CS40.15	229	230	Canyon Diablo East Safety Improvements	-	Improve skid resistance (reconstruct pavement, increase super-elevation, or mill and replace) Install chevrons and curve warning signs Install dynamic speed feedback system near WB MP 230 and EB MP 229 Install safety edge Enhance delineation (striping, delineators, rumble strips) Rehabilitate/widen inside shoulder Retrofit Roadside Weather Information System (RWIS) at MP 230 (Two Guns)	М
CS40.16	225 W.D	225 M/D	Puffala Bango TLOD WP Bridge	Α	Rehabilitate/repair Buffalo Range TI OP WB bridge	Р
C340.16	225 WB	225 WB	Buffalo Range TI OP WB Bridge	В	Replace Buffalo Range TI OP WB bridge	M
CS40.17	258	266	East Winslow Safety Improvements	-	Improve skid resistance (reconstruct pavement, increase super-elevation, or mill and replace) MP 258-260 Install dynamic speed feedback system near WB MP 260 and EB MP 258 Install safety edge Enhance delineation (striping, delineators, rumble strips) Install Closed Circuit Television (CCTV) Cameral near existing DMS located at MP 260.2 WB	М
CS40.18	274 WB	275 WB	Joseph City Pavement	Α	Rehabilitate/repair pavement	Р
CS40.10	274 000	273 VVD	Joseph Oily Favernerit	В	Replace pavement	M
CS40.19	284 EB	284 EB	Leroux Wash BR EB Bridge	Α	Rehabilitate/repair Leroux Wash BR EB bridge	Р
	20125	20125	Lereax Waen Bix EB Bridge	В	Replace Leroux Wash BR EB bridge	М
CS40.20	284 WB	284 WB	Leroux Wash BR WB Bridge	Α	Rehabilitate/repair Leroux Wash BR WB bridge	Р
			2.0.90	В	Replace Leroux Wash BR WB bridge	M
CS40.21	290 WB	290 WB	E Holbrook TI OP WB Bridge	A	Rehabilitate/repair E Holbrook TI OP WB bridge	P
CS40.22	200 55	200 55	-	В	Replace E Holbrook TI OP WB bridge	M
CS40.22	290 EB	290 EB	E Holbrook TI OP EB Bridge	Α	Rehabilitate/repair E Holbrook TI OP EB bridge	Р

<sup>\* &#</sup>x27;-': Indicates only one solution is being proposed and no options are being considered



Solution #	ВМР	ЕМР	Name	Option*	Scope	Investment Category (P/M/E)
				В	Replace E Holbrook TI OP EB bridge	M
CS40.23	311.5	311.5	Painted Desert TI UP Bridge	Α	Rehabilitate/repair Painted Desert TI UP bridge	Р
0040.20	311.5	311.5	l'ainted Desert II of Bridge	В	Replace Painted Desert TI UP bridge	M
CS40.24	345	351	Lupton West Safety Improvement	-	Improve skid resistance (reconstruct pavement, increase super-elevation, or mill and replace) MP 345-346, 346.5-347, 349.5-350.5 Install dynamic speed feedback system MP 345 EB and MP 351 WB Install chevrons and curve warning signs MP 345-346, 346.5-347, 349.5-350.5 Enhance delineation (striping, delineators, rumble strips) Install safety edge Install dynamic wind warning system near MP 349- 350 Install Roadside Weather Information System (RWIS) near MP 349-350	М
CS40.25	351	360	Lupton East Safety Improvement	-	Enhance delineation (striping, delineators, rumble strips) Install safety edge	М
CS40.26	347.5	359.5	Lupton TI Improvements	-	Construct/extend parallel entrance/exit ramps at Houck TI (MP 348), Lupton TI (MP 359), and WB rest area (MP 359)	М
CS40.27	358 WB	358 WB	Window Rock TLOP WB Bridge	Α	Rehabilitate/repair Window Rock TI OP WB bridge	Р
0040.27	330 44 D	000 VVD	Window Rock TI OP WB Bridge	В	Replace Window Rock TI OP WB bridge	M

<sup>\* &#</sup>x27;-': Indicates only one solution is being proposed and no options are being considered



### 3.1 Life-Cycle Cost Analysis

A LCCA was conducted for any bridge or pavement candidate solutions that contain multiple options. The intent of the LCCA was to determine which options warrant further investigation and eliminate options that would not be considered strategic. All dollar amounts are in 2015 dollars.

Life-Cycle Cost Analysis is an economic analysis that compares cost streams over time and presents the results in a common measure, the present value of all future costs. The cost stream occurs over an analysis period that is long enough to provide a reasonably fair comparison among alternatives that may differ significantly in scale of improvement actions over shorter time periods. For both bridge and pavement LCCA, the costs are focused on agency (ADOT) costs for corrective actions to meet the objective of keeping the bridge or pavement serviceable over a long period of time. User costs were not directly considered.

LCCA is performed to provide a more complete holistic perspective on asset performance and agency costs over the life of an investment stream. This approach helps ADOT look beyond initial and short term costs which often dominate the considerations in transportation investment decision making and programming.

### Bridge

For the bridge LCCA, three basic strategies were analyzed that differ in timing and scale of improvement actions to maintain the selected bridges, as described below:

- Bridge replacement (large upfront cost but small ongoing costs afterwards).
- Bridge rehabilitation until replacement (moderate upfront costs then small to moderate ongoing costs until replacement).
- On-going repairs until replacement (low upfront and more frequent ongoing costs until replacement).

The bridge LCCA model developed for the Corridor Profile Studies reviews the characteristics of the candidate bridges including bridge ratings and deterioration rates to develop the three improvement strategies (full replacement, rehabilitation until replacement, and repair until replacement). Each strategy consists of a set of corrective actions that contribute to keeping the bridge serviceable over the analysis period. Cost and effect of these improvement actions on the bridge condition are essential parts of the model. Other considerations in the model include bridge age, elevation, pier height, length to span ratio, skew angle, and substandard characteristics such as shoulders and vehicle clearance. The following assumptions are included in the bridge LCCA model:

- The bridge LCCA only addresses the structural condition of the bridge and does not address other issues or costs.
- The bridge will require replacement near the end of its 75 year service life regardless of current condition.
- The bridge elevation, pier height, skew angle, and length to span ratio can affect the replacement and rehabilitation costs.

- The current and historical ratings were used to estimate a rate of deterioration for each candidate bridge.
- Following bridge replacement, repairs will be needed every 20 years.
- Different bridge repair and rehabilitation strategies have different costs, expected service life, and benefit to the bridge rating.
- The present value of future costs was calculated at a 3% discount rate.
- If the LCCA evaluation recommends rehabilitation or repair, the project was not considered strategic and the rehabilitation or repair will be addressed by normal programming processes.
- Because this LCCA is conducted at a planning level, and due to the variabilities in costs and improvement strategies, the LCCA net present value results that are within 10% - 15% should be considered equally. In such a case, the project should be carried forward as a strategic replacement project – more detailed scoping will confirm if replacement or rehabilitation is needed.

Based on the candidate solutions presented in **Table 2**, LCCA was conducted on nine bridges on the I-40 East corridor. A summary of this analysis is shown in **Table 3**. Additional information regarding the LCCA is contained in **Appendix B**.

### <u>Pavement</u>

The LCCA approach to pavement was very similar to the process used for bridges. For the pavement LCCA, three basic strategies were analyzed that differ in timing and scale of improvement actions to maintain the selected pavement, as described below:

- Pavement replacement (large upfront cost but small ongoing costs afterwards—could be replacement with asphalt or concrete pavement)
- Pavement major rehabilitation until replacement (moderate upfront costs then small to moderate ongoing costs until replacement)
- Pavement minor rehabilitation until replacement (low upfront and ongoing costs until replacement)

The pavement LCCA model developed for the Corridor Profile Studies reviewed the characteristics of the candidate paving locations including the historical rehabilitation frequency to develop potential improvement strategies (full replacement, major rehabilitation until replacement, minor rehabilitation until replacement, for either concrete or asphalt, as applicable). Each strategy consists of a set of corrective actions that contribute to keeping the pavement serviceable over the analysis period. The following assumptions are included in the pavement LCCA model:

- The pavement LCCA will only address the condition of the pavement and will not address other issues or costs.
- The historical pavement rehabilitation frequencies at each location were used to estimate the future rehabilitation frequencies.



- Different pavement replacement and rehabilitation strategies have different costs and expected service life.
- The net present value of future costs will be discounted at 3%.
- If the LCCA evaluation recommends rehabilitation, the project will not be considered strategic and the rehabilitation will be addressed by normal programming processes.
- Because this LCCA is conducted at a planning level, and due to variabilities in costs and improvement strategies, the LCCA net present value results that are within 10%-15% should be considered equally. In such a case, the project should be carried forward as a strategic replacement project – more detailed scoping will confirm if replacement or rehabilitation is needed.

Based on the candidate solutions presented in **Table 2**, LCCA was conducted for two pavement solutions on the I-40 East corridor. A summary of this analysis is shown in **Table 4**. Additional information regarding the LCCA is contained in **Appendix B**.

As shown in Tables 3 and 4, the following conclusions were determined based on the LCCA:

- Rehabilitation or repair was determined to be the most effective approach for the candidate solutions listed below and these locations do not have other Needs that relate directly to the bridge. Therefore, it is assumed that the identified needs will be addressed by normal programming processes and these candidate solutions will be dropped from further consideration.
  - Lone Tree Road OP EB Bridge (CS40.01)(MP EB 196)
  - o Lone Tree Road OP WB Bridge (CS40.02)(MP WB 196)
  - o Buffalo Range TI OP WB Bridge (CS40.16) (MP WB 225)
  - o Leroux Wash BR EB Bridge (CS40.19)(MP EB 284)
  - o Leroux Wash BR WB Bridge (CS40.20)(MP WB 284)
  - o E Holbrook TI OP WB Bridge (CS40.21)(MP WB 290)
  - o E Holbrook TI OP EB Bridge (CS40.22)(MP EB 290)
  - o Painted Desert TI UP Bridge (CS40.23)(MP 311.5)
  - o Window Rock TI OP WB Bridge (CS40.27) (MP WB 358)
  - o Joseph City Pavement (CS 40.18)(MP WB 274-275)



Table 3: Bridge LCCA Results

Candidate Solution	Present '	Value at 3% Discour	nt Rate (\$)	Ratio of Present V	/alue Compared to Low	vest Present Value	Other	Results
Canadate Colution	Replace	Rehab	Repair	Replace	Rehab	Repair	Needs	Results
Lone Tree Road OP EB Bridge (CS40.01)	\$1,809,000	\$1,542,000	\$1,191,000	1.52	1.29	1.00	Yes	Not strategic as a stand-alone solution and other needs are not related to bridge; no further evaluation
Lone Tree Road OP WB Bridge (CS40.02)	\$1,809,000	\$1,549,000	\$1,201,000	1.51	1.29	1.00	Yes	Not strategic as a stand-alone solution and other needs are not related to bridge; no further evaluation
Buffalo Range TI OP WB Bridge (CS40.16)	\$1,769,000	\$1,420,000	\$1,160,000	1.52	1.22	1.00	Yes	Not strategic as a stand-alone solution and other needs are not related to bridge; no further evaluation
Leroux Wash BR EB Bridge (CS40.19)	\$7,068,000	\$6,359,000	\$4,006,000	1.76 1.59		1.00	No	Not strategic as a stand-alone solution and no other Needs—no further evaluation
Leroux Wash BR WB Bridge (CS40.20)	\$7,068,000	\$6,419,000	\$5,911,000	1.20	1.09	1.00	No	Not strategic as a stand-alone solution and no other Needs—no further evaluation
E Holbrook TI OP WB Bridge (CS40.21)	\$4,353,000	\$3,328,000	\$2,582,000	1.69	1.29	1.00	No	Not strategic as a stand-alone solution and no other Needs—no further evaluation
E Holbrook TI OP EB Bridge (CS40.22)	\$4,353,000	\$3,461,000	\$2,856,000	1.52	1.21	1.00	No	Not strategic as a stand-alone solution and no other Needs—no further evaluation
Painted Desert TI UP Bridge (CS40.23)	\$3,544,000	\$2,967,000	\$2,615,000	1.36	1.13	1.00	No	Not strategic as a stand-alone solution and no other Needs—no further evaluation
Window Rock TI OP WB Bridge (CS40.27)	\$572,000	\$516,000	\$418,000	1.37	1.23	1.00	Yes	Not strategic as a stand-alone solution and other needs are not related to bridge; no further evaluation

## **Table 4: Pavement LCCA Results**

0 111 0 1 11		Present Value at 3%	% Discount Rate (\$)		Ratio of Pro	esent Value Comp	ared to Lowest Pres	ent Value	Other	Decelle	
Candidate Solution	Concrete Asphalt		Asphalt Medium		Concrete Asphalt		Asphalt Medium		Needs	Results	
	Reconstruction	Reconstruction	Rehabilitation	Rehabilitation	Reconstruction	Reconstruction	Rehabilitation	Rehabilitation			
West of Walnut Canyon Rd	\$4,523,000	\$4,739,000	\$4,023,000	\$4,556,000	1.12	1.18	1.00	1.13	Yes	Strategic as a stand-alone solution; recommend	
(CS40.11)(MP EB 203-204)	\$4,525,000	φ <del>4</del> ,739,000	\$4,023,000	\$4,550,000	1.12	1.10	1.00		1.13	165	further evaluation
Joseph City	\$4,523,000	\$4,739,000	\$3,810,000	\$4,202,000	1.19	1.24	1.00	1.10	No	Not strategic as a stand-alone solution and no other	
(CS40.18)(MP WB 274-275)	φ4,523,000	φ <del>4</del> ,7 39,000	φ3,610,000	φ <del>4</del> ,∠02,000	1.19	1.24	1.00	1.10	INO	needs present – no further evaluation	



### 3.2 Performance Effectiveness Evaluation

The results of the performance Effectiveness Evaluation will be combined with the results of a risk analysis to determine a Performance Effectiveness Score. The objectives of the Performance Effectiveness Evaluation include:

- Measure of benefit in performance system versus cost of solution
- Include risk factors to help differentiate between similar solutions
- Applicable to each Performance Area that is affected by the candidate solution
- Accounts for Emphasis Areas that were identified for the corridor

The Performance Effectiveness Evaluation includes the following steps:

- Estimate the post-project performance for each of the five performance areas (Bridge, Pavement, Safety, Mobility, and Freight)
- Use the post-solution performance scores to calculate a post-solution level of Need for each
  of the five performance areas
- Compare the pre-solution level of Need to the post-solution level of Need to determine the reduction in level of Need (potential project benefit) for each of the five performance areas
- Calculate performance area risk weighting factors for each of the five performance areas
- Using the reduction in level of Need (benefit) and risk weighting factors, calculate the Performance Effectiveness Score

For each Performance Area, a slightly different approach was used to estimate the post-project performance. This process was based on the following assumptions:

### Pavement:

- The IRI rating would decrease (to 30 for replacement or 45 for rehabilitation)
- The Cracking rating would decrease (to 0 for replacement or rehabilitation)

### • Bridge:

- The structural ratings would increase (+1 for repair, +2 for rehabilitation, or increase to 8 for replacement)
- The bridge sufficiency rating would increase (+10 for repair, +20 for rehabilitation, or increase to 98 for replacement)

### Mobility:

- Additional lanes would increase the capacity and therefore revise the Mobility Index and two secondary measures
- Other improvements (ramp metering, parallel ramps, variable speed limits) will also increase the capacity (to a lesser extent than additional lanes) and therefore revise the Mobility Index and two secondary measures
- Changes in the Mobility Index (due to increased capacity) would have a direct effect on the TTI secondary measure

- Changes in the Mobility Index (due to increased capacity) and Safety Index (due to crash reductions) would have a direct effect on the PTI secondary measure
- Changes in the Safety Index (due to crash reductions) would have direct effect on the Closure Extent secondary measure

### • Safety:

 Crash Modification Factors were developed and applied to estimate the reduction in crashes (for additional information see **Appendix C**)

### Freight:

- Changes in the Mobility Index (due to increased capacity) and Safety Index (due to crash reductions) would have a direct effect on the Freight Index and the TPTI secondary measure
- Changes in the Mobility Index (due to increased capacity) would have a direct effect on the TTTI secondary measure
- Changes in the Safety Index (due to crash reductions) would have direct effect on the Closure Duration secondary measure

The Performance Area Risk Assessment is intended to develop a numeric risk weighting factor for each of the five Performance Areas (Bridge, Pavement, Safety, Mobility, and Freight). This risk assessment addresses other considerations for each Performance Area that are not directly included in the Performance System. A risk weighting factor is calculated for each candidate solution based on the specific characteristics at the project location. For example, the Pavement Risk Factor is based on factors such as the elevation, daily traffic volumes, and amount of truck traffic. Additional information regarding the Performance Area Risk Factors is included in **Appendix D**.

Following the calculation of the reduction in level of Need (benefit) and the Performance Area Risk Factors, these values were used to calculate the Performance Effectiveness Score. In addition, the reduction in level of Need in each Emphasis Area was also included the in the Performance Effectiveness Score.

The benefit (reduction in Need) is measured as a one-time benefit. However, different types of solutions will have varying service lives during which the benefits will be obtained. For example, a preservation solution would likely have a shorter stream of benefits over time when compared to a modernization or expansion solution. To address the varying lengths of benefit streams, each solution was classified as a 10-year, 20-year, 30-year, or 75-year benefit stream (the  $F_{NPV}$  factor). A 3% discount rate was used to calculate  $F_{NPV}$  for each classification of solution. The service lives and respective factors are described below:

 A 10-year service life is generally reflective of a preservation solution. This would include pavement and bridge preservation solutions which would likely have a 10 year stream of benefits. For these solutions, a F<sub>NPV</sub> of 8.8 was used in the PES calculation (based on a 3% discount rate).



- A 20-year service life is reflective of modernization solutions that generally do not include new infrastructure. These solutions would likely have a 20 year stream of benefits. For these solutions, a F<sub>NPV</sub> of 15.3 was used in the PES calculation (based on a 3% discount rate).
- A 30-year service life is generally reflective of an expansion solution or a modernization solution that includes new infrastructure. These solutions would likely have a 30 year stream of benefits. For these solutions, a F<sub>NPV</sub> of 20.2 was used in the PES calculation (based on a 3% discount rate).
- A 75-year service life was used for bridge replacement solutions. For these solutions, a F<sub>NPV</sub> of 30.6 was used in the PES calculation (based on a 3% discount rate).

Each solution also has varying degrees of exposure depending on the length of the solution and the daily traffic volume. The vehicle-miles travelled (VMT) at each solution provides a measure of the amount of traffic that would receive the benefit of the proposed solution. The following equation was used to calculate a factor (between 0 and 5) which was used in the calculation of the Performance Effectiveness Score.

$$F_{VMT} = 5 - (5 \times e^{VMT \times -0.0000139})$$

The performance Effectiveness Score (PES) can be described as follows:

PES = (Sum of all Risk Factored Benefit Scores + Sum of all Risk Factored Emphasis Area Scores) / Cost  $x F_{VMT} x F_{NPV}$ 

Where,

- Risk Factored Benefit Score = Reduction in Segment-Level Need (benefit) x Performance Area Risk Weighting Factor (calculated for each Performance Area)
- Risk Factored Emphasis Area Score = Reduction in Corridor-Level Need x Performance Area Risk Factors x Emphasis Area Factor (calculated for each Emphasis Area)
- Cost = estimate cost of candidate solution in \$millions (see Appendix A)
- $F_{VMT}$  = Factor between 0 and 5 to account for vehicle miles travelled at location of candidate solution based on current (2014) daily volume and length of solution
- $F_{NPV}$  = Factor (ranging from 8.8 to 30.6, see above) to address anticipated longevity of service life (and duration of benefits) for each candidate solution

The resulting PES values are shown in **Table 5**. Additional information regarding the calculation of the PES is contained in **Appendix E**.



**Table 5: Initial Performance Effectiveness Scores** 

Candidate	Candidate Solution	Milepost	Estimated		Risk Fa	ctored Benefi	t Score		Risk Factor	ed Emphasis A	rea Scores	Total			Performance
Solution #	Name	Location	Cost* (\$ million)	Pavement	Bridge	Safety	Mobility	Freight	Safety	Pavement	Bridge	Factored Benefit Score	F <sub>VMT</sub>	F <sub>NPV</sub>	Effectiveness Score
40.03	Flagstaff Safety Improvements	196 – 200	\$10.20	0.00	0.00	5.35	0.35	0.26	0.04	0.00	0.00	5.99	4.38	15.3	39.4
40.04	Flagstaff Lighting	196 – 202	\$8.06	0.00	0.00	3.75	0.12	0.18	0.02	0.00	0.00	4.07	4.78	15.3	37.0
40.05	Flagstaff Pedestrian Improvements	198 - 200	\$2.82	0.00	0.00	11.27	0.32	0.49	0.07	0.00	0.00	12.08	0.61	20.2	53.4
40.06	Butler TI	198.5 – 199.5	\$4.43	0.00	0.00	6.04	0.09	0.22	0.03	0.00	0.00	6.38	1.15	20.2	33.5
40.07	East Flagstaff Safety Improvements	200 - 207	\$23.59	0.00	0.00	5.07	0.23	0.45	0.05	0.00	0.00	5.79	3.44	15.3	12.9
40.08	Walnut Canyon & Cosnino TI Lighting	204.5 – 207.5	\$0.99	0.00	0.00	1.82	0.12	0.17	0.03	0.00	0.00	2.14	1.16	15.3	38.5
40.09	Winona Safety Improvements	207 - 212	\$22.21	0.00	0.00	3.86	0.61	0.59	0.06	0.00	0.00	5.11	3.67	15.3	12.9
40.10	Country Club and Walnut Canyon	201.5 – 205.5	\$8.85	0.00	0.00	2.13	0.15	0.31	0.03	0.00	0.00	2.63	1.16	20.2	7.0
40.11	West of Walnut Canyon Pavement	202 – 205 EB	\$12.92	1.19	0.00	0.10	0.01	0.01	0.00	0.06	0.00	1.36	1.65	15.3	2.7
40.12	Canyon Diablo West Safety Improvements	218 – 220	\$10.05	0.00	0.00	1.26	0.17	0.23	0.04	0.00	0.00	1.70	1.81	15.3	4.7
40.13	Canyon Diablo Safety Improvements	220 – 229	\$13.95	0.00	0.00	0.91	0.15	0.16	0.03	0.00	0.00	1.25	4.34	15.3	6.0
40.14	Twin Arrows TI	219.5 – 220.5	\$4.43	0.00	0.00	1.33	0.17	0.24	0.04	0.00	0.00	1.77	1.01	20.2	8.1
40.15	Canyon Diablo East Safety Improvements	229 - 230	\$5.09	0.00	0.00	0.41	0.04	0.08	0.01	0.00	0.00	0.54	1.01	15.3	1.6
40.17	East Winslow Safety Improvements	258 - 266	\$10.86	0.00	0.00	1.89	0.06	0.01	0.03	0.00	0.00	2.00	4.17	15.3	11.7
40.24	Lupton West Safety Improvement	345 -351	\$11.86	0.00	0.00	1.78	0.01	0.02	0.03	0.00	0.00	1.85	3.68	15.3	8.8
40.25	Lupton East Safety Improvements	351 - 359	\$4.60	0.00	0.00	0.79	0.03	0.01	0.02	0.00	0.00	0.85	4.33	15.3	12.2
40.26	Lupton Area TI Improvements	347.5 – 359.5	\$9.96	0.00	0.00	1.21	0.02	0.01	0.03	0.00	0.00	1.27	1.21	20.2	3.1

<sup>\*:</sup> See Table 6 for total construction costs



### 4 CANDIDATE SOLUTION PRIORTIZATION

Following the calculation of the Performance Effectiveness Scores (PES), an additional step was taken to develop the prioritized list of solutions. A risk probability and consequence analysis was conducted to develop a project-level risk weighting factor. This risk analysis is a numeric scoring system to help address the risk of not implementing a solution based on the likelihood and severity of the performance failure. **Figure 4** shows the risk matrix that was used to develop the risk weighting factors.

Figure 4: Risk Matrix

		Severity/Consequence									
		Insignificant Minor		Significant	Major	Catastrophic					
po	Very Rare	Low	Low	Low	Moderate	Major					
celiho	Rare	Low	Low	Moderate	Major	Major					
Frequency/Likelihood	Seldom	Low Moderate		Moderate	Major	Severe					
dneu	Common	Moderate	Moderate	Major	Severe	Severe					
Fre	Frequent	Moderate	Major	Severe	Severe	Severe					

Using the risk matrix in **Figure 4**, numeric values were assigned to each category of frequency and severity. The higher the risk, the higher the numeric factor that was assigned. The risk weight for each area of the matrix was calculated by multiplying the severity factor times the frequency factor. These numeric factors are shown in **Figure 5**.

Figure 5: Numeric Risk Matrix

				Sev	erity/Conseque	ence	
			Insignificant	Minor	Significant	Major	Catastrophic
		Weight	1.00	1.10	1.20	1.30	1.40
poc	Very Rare	1.00	1.00	1.10	1.20	1.30	1.40
keliho	Rare	1.10	1.10	1.21	1.32	1.43	1.54
cy/Lil	Seldom	1.20	1.20	1.32	1.44	1.56	1.68
Frequency/Likelihood	Common	1.30	1.30	1.43	1.56	1.69	1.82
Frec	Frequent	1.40	1.40	1.54	1.68	1.82	1.96

Using the values in **Figure 5**, risk weighting factors were calculated for each of the four risk categories (low, moderate, major, and severe). These values are simply the average of the values in Figure 5 that fall within each category. The resulting average risk weighting factors are:

<u>Low</u>	<u>Moderate</u>	<u>Major</u>	<u>Severe</u>
1.14	1.36	1.51	1.78

The risk weighting factors listed above were assigned to the five performance areas as follows:

- Safety = 1.78
  - The Safety performance area quantifies the likelihood of fatal or incapacitating crashes; therefore, it was assigned the highest (Severe) risk weight.
- Bridge = 1.51
  - The Bridge performance area focuses on the structural adequacy of the bridges. A failure may result in crashes (that would not be addressed in the Safety performance area) or traffic being detoured for long periods of time resulting in significant travel time increases; therefore, it was assigned the Major (1.24) risk weighting factor.
- Mobility and Freight = 1.36
  - The Mobility and Freight performance areas focus on capacity and congestion. Failure in either of these performance areas would result in increased travel times but would not have significant effect on safety (crashes) that would not already be addressed in the Safety performance area; therefore, they were assigned the Moderate (1.18) risk weighing factor.
- Pavement = 1.14
  - The Pavement performance area focuses on the ride quality of the pavement. Failure in this performance area would likely be a spot location that would not dramatically affect drivers beyond what is already captured in the Safety performance area.

The benefit in each performance area was calculated for each candidate solution as part of the Performance Effectiveness Evaluation. Using this information, and the risk factors listed above, a weighted (based on benefit) solution-level numeric risk factor was calculated for each candidate solution. For example, a solution that has 50% of its benefit in Safety and 50% of its benefit in Mobility would have a risk factor of 1.27 (0.50 x 1.18 + 0.50 x 1.36 = 1.27). These risk factors were applied directly to the Performance Effectiveness Scores shown in **Table 5**. Candidate Solutions were prioritized based on these results, as shown in **Table 6**. Additional information regarding the prioritization scores is contained in **Appendix F**.

PS = PES x Risk Factor x Segment Need (see **Appendix E** for additional information)

Where,

PES = Performance Effectiveness Score (Table 5)

Risk Factor = Factor to address risk of not implementing a solution based on the likelihood and severity of the performance failure

Segment Need = Composite segment need score (Working Paper 4)



Table 6 prioritizes the strategic solutions recommended as a result of this corridor profile study and identifies the overall percentage of need reduction as a result of each solution. These solutions were developed to increase the performance of the I-40 East corridor across all performance areas. Solutions that address multiple areas score higher in this process.

- Four solutions result in a Prioritization Score above 80 which shows that their performance benefits are much higher than their cost.
- Two of the top four solutions include the installation of lighting in locations where 60% 70% of the fatal and serious injury crashes occur in dark conditions.
- All six of the highest ranking solutions are located where the Safety Index was the highest along the corridor.

• Two safety hotspots were identified along the corridor and those corresponding solutions are ranked in the top six.

**Table 6: Prioritized Recommended Solutions List** 

Rank	Candidate Solution #	Candidate Solution Name	Milepost Location	Estimated Cost* (\$ million)	Performance Effectiveness Score	Risk Factor	Segment Need	Prioritization Score	Solution Need Reduction Notes
1	40.05	Flagstaff Pedestrian Improvements	198-200	\$2.82	53.4	1.75	1.23	115	Reduces Safety need by 77%
2	40.08	Walnut Canyon & Cosnino TI Lighting	204.5 - 207.5	\$0.99	38.5	1.72	1.46	97	Reduces Safety need by 15%
3	40.03	Flagstaff Safety Improvements	196 – 200	\$10.41	39.4	1.74	1.23	84	Reduces Safety need by 37%
4	40.04	Flagstaff Lighting	196 – 202	\$8.06	37.0	1.75	1.23	80	Reduces Safety need by 26%
5	40.06	Butler TI	198.5 - 199.5	\$4.43	33.5	1.76	1.23	73	Reduces Safety need by 42%
6	40.09	Winona Safety Improvements	207 - 212	\$22.98	12.9	1.68	1.46	32	Reduces Safety need by 38%
7	40.25	Lupton East Safety Improvements	351 - 359	\$4.60	12.2	1.76	1.46	31	Reduces Safety need by 19%
8	40.07	East Flagstaff Safety Improvements	200 - 207	\$23.59	12.9	1.72	1.39	31	Reduces Safety need by 19%
9	40.17	East Winslow Safety Improvements	258 - 266	\$10.92	11.7	1.76	1.15	24	Reduces Safety need by 63%
10	40.24	Lupton West Safety Improvements	345 -351	\$12.10	8.8	1.77	1.46	23	Reduces Safety need by 32%
11	40.14	Twin Arrows TI	219.5 – 220.5	\$4.43	8.1	1.68	1.46	20	Reduces Safety need by 25%
12	40.10	Country Club & Walnut Canyon	201.5 – 205.5	\$8.85	7.0	1.71	1.46	17	Reduces Safety need by 17%
13	40.13	Canyon Diablo Safety Improvements	220 – 229	\$14.20	6.0	1.68	1.46	15	Reduces Safety need by 17%
14	40.12	Canyon Diablo West Safety Improvements	218 – 220	\$10.05	4.7	1.68	1.46	12	Reduces Safety need by 23%
15	40.26	Lupton Area TI Improvements	347.5 - 360	\$9.96	3.1	1.77	1.46	8	Reduces Safety need by 22%
16	40.11	West of Walnut Canyon Pavement	202-205 EB	\$12.92	2.7	1.19	1.43	5	Reduces Pavement need by 32%
17	40.15	Canyon Diablo East Safety Improvements	229 - 230	\$5.24	1.6	1.68	1.46	4	Reduces Safety need by 8%

<sup>\*:</sup> Cost may vary from Table 5 due to additional ITS components



### **5 NEXT STEPS**

The strategic investments recommended in this study are not intended to be a substitute or replacement for traditional ADOT project development processes where various ADOT technical groups and districts develop candidate projects for consideration in the performance-based programming in the P2P Link process. Rather, these strategic investments are intended to complement ADOT's project development processes with non-traditional solutions to address performance needs in one or a combination of the five performance areas of Pavement, Bridge, Mobility, Safety, and Freight. Strategic investments developed for the I-40 East corridor will be considered along with other candidate projects in the ADOT statewide programming process.

The concluding step in the corridor profile studies will be to produce a final report for the Round 2 studies (I-40E, I-8, and SR95) that summarizes working papers 1 through 6. Additional final reports for rounds 3 will be completed following the full development of those working papers.

Upon completion of all three rounds, the results will be incorporated into a summary document comparing all corridors and is expected to provide a performance-based review of statewide needs.



September 2016 I-40 East Corridor Profile Study Working Paper #6

I-40 Cor	ridor Solution Cost Es	timates									PE	Design	ROW	
<u>CS #</u>	Project Name	<u>Solution</u>	<u>BMP</u>	<u>EMP</u>	<u>Length</u>	Sq Ft	<u>Each</u>	<u>Unit</u>	<u>Unit Cost</u>	Total Construction Cost	0.03	0.10	-	Total
		Enhance delineation (striping, delineators, rumble strips)	196.0	200.0	8			mile	\$50,100	\$400,800	\$12,000	\$40,000	\$ -	\$452,800
		Install safety edge	196.0	200.0	8			mile	\$176,000	\$1,408,000	\$42,000	\$141,000	\$ -	\$1,591,000
		Install Roadside Weather Information System (RWIS)	196.0	202.0			1	each	\$132,000	\$132,000	\$ 4,000	\$13,000	\$ -	\$149,000
		Implement variable speed limits (wireless, ground mount)	196.0	200.0	8			mile	\$373,300	\$2,986,400	\$90,000	\$299,000	\$ -	3,375,400
40.03	Flagstaff Safety Improvements	Rehabilitate/widen inside shoulder	196.0	200.0	8			mile	\$460,000	\$3,680,000	\$110,000	\$368,000	\$ -	4,158,000
	improvements	Install in-lane route pavement markings					2	each	\$13,200	\$26,400	\$1,000	\$3,000	\$ -	\$ 30,400
		Install rock fall mitigation	198.5	199.0	1			mile	\$1,045,000	\$522,500	\$16,000	\$52,000	\$ -	\$590,500
		Install CCTV Camera on existing DMS (EB)	199.6	199.6			1	each	\$55,000	\$55,000	\$2,000	\$6,000	\$ -	63,000
		TOTAL								\$9,211,100	\$277,000	\$922,000		\$10,410,100
40.04	Coconino Safety Improvements	Install lighting	196.0	202.0	12			mile	\$594,000	\$7,128,000	\$214,000	\$713,000	\$ -	8,055,000
	Flagstaff	Install access barrier fence	198.0	200.0	21,120			LF	\$ 33	\$696,960	\$21,000	\$70,000	\$ -	\$787,960
40.05	Pedestrian	Ped crossing/bridge			600	6,000		SF	\$300	\$1,800,000	\$ 54,000	\$180,000	\$ -	\$ 2,034,000
	Improvements	TOTAL								\$2,496,960	\$75,000	\$ 250,000		\$ 2,821,960
40.06	Butler TI	Construct/extend parallel entrance/exit ramps @ Butler TI	199.0	199.0			4	each	\$979,000	\$3,916,000	\$117,000	\$ 392,000	\$ -	\$ 4,425,000
		Implement variable speed limits (wireless, ground mount)	200	207	14				\$ 373,300	\$ 5,226,200	\$ 157,000	\$ 523,000	\$ -	\$ 5,906,200
		Install Safety Edge	200	207	14				\$ 176,000	\$ 2,464,000	\$ 74,000	\$ 246,000	\$ -	\$ 2,784,000
		Enhance delineation (striping, delineators, rumble strips)	200	207	14				\$ 50,100	\$ 701,400	\$21,000	\$ 70,000	\$ -	\$ 792,400
40.07	East Flagstaff Safety	Rehabilitate/widen inside shoulder	200	207	14				\$ 460,000	\$ 6,440,000	\$ 193,000	\$ 644,000	\$ -	\$ 7,277,000
40.07	Improvements	Install chevrons and curve warning signs	200.0	202.0	4			mile	\$ 40,500	\$ 162,000	\$ 5,000	\$ 16,000	\$ -	\$ 183,000
	·	Improve skid resistance (reconstruct pavement, increase superelevation, or mill and replace)	200.0	202.0	4			mile	\$1,470,000	\$ 5,880,000	\$176,000	\$ 588,000	\$ -	\$ 6,644,000
		TOTAL								\$20,873,600	\$ 626,000	\$ 2,087,000	\$ -	\$ 23,586,600
		Install lighting (solar powered LED) at Walnut Canyon TI	205.0	205.0			20	each	\$ 22,000	\$ 440,000	\$13,000	\$ 44,000	\$ -	\$ 497,000
40.08	Walnut Canyon & Cosnino TI Lighting	Install lighting (solar powered LED) at Cosnino TI	207.0	207.0			20	each	\$ 22,000	\$ 440,000	\$ 13,000	\$ 44,000	\$ -	\$ 497,000
	Costillo 11 Lighting	TOTAL								\$ 880,000	\$ 26,000	\$ 88,000	\$ -	\$ 994,000
		Improve skid resistance (reconstruct pavement, increase superelevation, or mill and replace)	207.0	208.0	2			mile	\$1,470,000	\$2,940,000	\$ 88,000	\$ 294,000	\$ -	\$ 3,322,000
		Improve skid resistance (reconstruct pavement, increase superelevation, or mill and replace)	210.0	212.0	4			mile	\$1,470,000	\$ 5,880,000	\$176,000	\$ 588,000	\$ -	\$ 6,644,000
40.09	Winona Safety	Install Safety Edge	207.0	212.0	10			mile	\$ 176,000	\$ 1,760,000	\$ 53,000	\$ 176,000		\$ 1,989,000
	Improvements	Rehabilitate/widen inside shoulder	207.0	212.0	10			mile	\$ 460,000	\$ 4,600,000	\$ 138,000	\$ 460,000		\$ 5,198,000
		Enhance delineation (striping, delineators, rumble strips)	207.0	212.0	10			mile	\$ 50,100	\$ 501,000	\$ 15,000	\$ 50,000		\$ 566,000
		Implement variable speed limits (wireless, ground mount)	207.0	212.0	10			mile	\$ 373,300	\$ 3,733,000	\$ 112,000	\$ 373,000		\$ 4,218,000
		Install chevrons and curve warning signs	207.0	208.0	2			mile	\$ 40,500	\$ 81,000	\$ 2,000	\$ 8,000	\$ -	\$ 91,000

I-40 Coi	ridor Solution Cost Es	timates									PE	Design	ROW	
<u>CS #</u>	<u>Project Name</u>	<u>Solution</u>	ВМР	<u>EMP</u>	<u>Length</u>	<u>Sq Ft</u>	<u>Each</u>	<u>Unit</u>	<u>Unit Cost</u>	Total Construction Cost	0.03	0.10	-	Total
		Install chevrons and curve warning signs	210.0	212.0	4			mile	\$ 40,500	\$ 162,000	\$ 5,000	\$ 16,000	\$ -	\$ 183,000
		Install Roadside Weather Information System (RWIS)					1	each	\$ 132,000	\$ 132,000	\$ 4,000	\$ 13,000		\$ 149,000
		Install new EB DMS with CCTV	212.1	212.1			1	each	\$ 550,000	\$ 550,000	\$ 17,000	\$ 55,000		\$ 622,000
		TOTAL								\$20,339,000	\$ 610,000	\$ 2,033,000	\$ -	\$ 22,982,000
		Construct/extend parallel entrance/exit ramps at Country Club TI	202.0	202.0			4	each	\$ 979,000	\$ 3,916,000	\$ 117,000	\$ 392,000	\$ -	\$ 4,425,000
40.10	Country Club & Walnut Canyon	Construct/extend parallel entrance/exit ramps at Walnut Canyon TI	205.0	205.0			4	each	\$ 979,000	\$ 3,916,000	\$ 117,000	\$ 392,000	\$ -	\$ 4,425,000
		TOTAL								\$ 7,832,000	\$ 234,000	\$ 784,000	\$ -	\$ 8,850,000
40.11	West of Walnut Canyon Pavement	Concrete Reconstruction (EB)	202.0	205.0	3			mile	\$3,810,000	\$11,430,000	\$ 343,000	\$ 1,143,000	\$ -	\$ 12,916,000
		Improve skid resistance (reconstruct pavement, increase superelevation, or mill and replace)	218.0	220.0	4			mile	\$1,470,000	\$ 5,880,000	\$176,000	\$ 588,000	\$ -	\$ 6,644,000
		Install chevrons and curve warning signs	218.0	220.0	4			mile	\$ 40,500	\$ 162,000	\$ 5,000	\$ 16,000		\$ 183,000
	Canyon Diablo	Install dynamic speed feedback system (EB)	218.0	218.0			1	each	\$ 55,000	\$ 55,000	\$ 2,000	\$ 6,000		\$ 63,000
40.12	West Safety	Install dynamic speed feedback system (WB)	220.0	220.0			1	each	\$ 55,000	\$ 55,000	\$ 2,000	\$ 6,000		\$ 63,000
	Improvements	Install safety edge	218.0	220.0	4			mile	\$ 176,000	\$ 704,000	\$ 21,000	\$ 70,000		\$ 795,000
		Enhance delineation (striping, delineators, rumble strips)	218.0	220.0	4			mile	\$ 50,100	\$ 200,400	\$ 6,000	\$ 20,000		\$ 226,400
		Rehabilitate/widen inside shoulder	218.0	220.0	4			mile	\$ 460,000	\$ 1,840,000	\$ 55,000	\$ 184,000		\$ 2,079,000
		TOTAL								\$ 8,896,400	\$ 267,000	\$ 890,000		\$ 10,053,400
		Install safety edge	220.0	229.0	18			mile	\$ 176,000	\$ 3,168,000	\$ 95,000	\$ 317,000		\$ 3,580,000
		Enhance delineation (striping, delineators, rumble strips)	220.0	229.0	18			mile	\$ 50,100	\$ 901,800	\$ 27,000	\$ 90,000		\$ 1,018,800
40.13	Canyon Diablo	Rehabilitate/widen inside shoulder	220.0	229.0	18			mile	\$ 460,000	\$ 8,280,000	\$ 248,000	\$ 828,000		\$ 9,356,000
40.13	Safety Improvement	Install Roadside Weather Information System (RWIS)	222.0	223.0			1	each	\$ 132,000	\$ 132,000	\$ 4,000	\$ 13,000		\$ 149,000
	improvement	Install dynamic wind warning system	222.0	223.0			1	each	\$ 88,000	\$ 88,000	\$ 3,000	\$ 9,000		\$ 100,000
		TOTAL								\$12,569,800	\$ 377,000	\$ 1,257,000		\$ 14,203,800
40.14	Twin Arrows TI	Construct/extend parallel entrance/exit ramps at Twin Arrows TI	220.0	220.0			4	each	\$ 979,000	\$ 3,916,000	\$ 117,000	\$ 392,000		\$ 4,425,000
		Improve skid resistance (reconstruct pavement, increase superelevation, or mill and replace)	229.0	230.0	2			mile	\$ 1,470,000	\$ 2,940,000	\$ 88,000	\$ 294,000	\$ -	\$ 3,322,000
	Canyon Diablo East	Install chevrons and curve warning signs	229.0	230.0	2			mile	\$ 40,500	\$ 81,000	\$ 2,000	\$ 8,000	\$ -	\$ 91,000
		Install dynamic speed feedback system (WB)	230.0	230.0			1	each	\$ 55,000	\$ 55,000	\$ 2,000	\$ 6,000	\$ -	\$ 63,000
40.15	Safety	Install dynamic speed feedback system (EB)	229.0	229.0			1	each	\$ 55,000	\$ 55,000	\$ 2,000	\$ 6,000	\$ -	\$ 63,000
	Improvements	Install safety edge	229.0	230.0	2			mile	\$ 176,000	\$ 352,000	\$ 11,000	\$ 35,000	\$ -	\$ 398,000
		Enhance delineation (striping, delineators, rumble strips)	229.0	230.0	2			mile	\$ 50,100	\$ 100,200	\$ 3,000	\$ 10,000	\$ -	\$ 113,200
		Rehabilitate/widen inside shoulder	229.0	230.0	2			mile	\$ 460,000	\$ 920,000	\$ 28,000	\$ 92,000	\$ -	\$ 1,040,000
		Retrofit Roadside Weather Information System (RWIS)	230.0	230.0			1	each	\$ 132,000	\$ 132,000	\$ 4,000	\$ 13,000		\$ 149,000

I-40 Cor	ridor Solution Cost Es	stimates									PE	Design	ROW	
<u>CS #</u>	<u>Project Name</u>	<u>Solution</u>	ВМР	<u>EMP</u>	<u>Length</u>	<u>Sq Ft</u>	<u>Each</u>	<u>Unit</u>	<u>Unit Cost</u>	Total Construction Cost	0.03	0.10	_	Total
		TOTAL								\$ 4,635,200	\$ 140,000	\$ 464,000		\$ 5,239,200
		Improve skid resistance (reconstruct pavement, increase superelevation, or mill and replace)	258.0	260.0	4			mile	\$1,470,000	\$5,880,000	\$ 176,000	\$ 588,000	\$ -	\$ 6,644,000
		Install dynamic speed feedback system (WB)	260.0	260.0			1	each	\$ 55,000	\$ 55,000	\$ 2,000	\$ 6,000	\$ -	\$ 63,000
40.47	East Winslow	Install dynamic speed feedback system (EB)	258.0	258.0			1	each	\$ 55,000	\$ 55,000	\$ 2,000	\$ 6,000	\$ -	\$ 63,000
40.17	Safety Improvements	Install safety edge	258.0	266.0	16			mile	\$ 176,000	\$ 2,816,000	\$84,000	\$ 282,000	\$ -	\$ 3,182,000
	improvements	Enhance delineation (striping, delineators, rumble strips)	258.0	266.0	16			mile	\$ 50,100	\$ 801,600	\$ 24,000	\$ 80,000	\$ -	\$ 905,600
		Install CCTV camera on existing DMS (WB)	260.2	260.2			1	each	\$ 55,000	\$ 55,000	\$ 2,000	\$ 6,000	\$ -	\$ 63,000
		TOTAL								\$ 9,662,600	\$ 290,000	\$ 968,000	\$ -	\$ 10,920,600
		Improve skid resistance (reconstruct pavement, increase superelevation, or mill and replace)	varies	varies	5			mile	\$1,470,000	\$7,350,000	\$176,000	\$ 588,000	\$ -	\$ 8,114,000
		Install dynamic speed feedback system (EB)	345.0	345.0			1	each	\$ 55,000	\$ 55,000	\$ 2,000	\$ 6,000	\$ -	\$ 63,000
		Install dynamic speed feedback system (WB)	351.0	351.0			1	each	\$55,000	\$ 55,000	\$ 2,000	\$ 6,000	\$ -	\$ 63,000
	Lupton West	Install chevrons and curve warning signs	345.0	351.0	12			mile	\$40,500	\$ 486,000	\$ 15,000	\$ 49,000	\$ -	\$ 550,000
40.24	Safety	Install dynamic wind warning system	349.0	350.0		12 mile \$40,500 \$ 486,000 \$ 15,000 \$ 49,000 1 each \$88,000 \$ 88,000 \$ 3,000 \$ 9,000	\$ -	\$ 100,000						
	Improvements	Enhance delineation (striping, delineators, rumble strips)	345.0	351.0	12			mile	\$50,100	601,200	\$ 18,000	\$ 60,000	\$ -	\$ 679,200
		Install safety edge	345.0	351.0	12			mile	\$ 176,000	\$ 2,112,000	\$ 63,000	\$ 211,000	\$ -	\$ 2,386,000
		Install Roadside Weather Information System (RWIS)					1	each	\$ 132,000	\$ 132,000	\$ 4,000	\$ 13,000	\$ -	\$ 149,000
		TOTAL								\$10,879,200	\$ 283,000	\$ 942,000		\$12,104,200
	Lupton East	Enhance delineation (striping, delineators, rumble strips)	351.0	360.0	18			mile	\$ 50,100	\$ 901,800	\$ 27,000	\$ 90,000	\$ -	\$ 1,018,800
40.25	Safety	Install safety edge	351.0	360.0	18			mile	\$ 176,000	\$ 3,168,000	\$ 95,000	\$ 317,000	\$ -	\$ 3,580,000
	Improvements	TOTAL								\$ 4,069,800	\$122,000	\$ 407,000		\$ 4,598,800
		Construct/extend parallel entrance/exit ramps at Houck TI	348.0	348.0			4	each	\$ 979,000	\$ 3,916,000	\$117,000	\$ 392,000	\$ -	\$ 4,425,000
	Lundon Arra Ti	Construct/extend parallel entrance/exit ramps at Lupton TI	359.0	359.0			4	each	\$ 979,000	\$ 3,916,000	\$117,000	\$ 392,000	\$ -	\$ 4,425,000
40.26	Lupton Area TI Improvements	Construct/extend parallel entrance/exit ramps at WB rest area TI	359.0	359.0			1	each	\$ 979,000	\$ 979,000	\$ 29,000	\$ 98,000	\$ -	\$ 1,106,000
		TOTAL								\$8,811,000	\$ 263,000	\$ 882,000		\$9,956,000

**Appendix B: Life-Cycle Cost Analysis** 

September 2016

LONE TREE RD EB OP (#1180) / I-	-40 / MP 196.26	5							
Bridge Information			<b>Deterioration Slope</b>						
Bridge Deck Area (A225)	4355 SF		Item	Deterioratio	n Line Equation		Year		
Year Built (N27)	1966		iteiii	Slope =	Days	Years	Drop		
Exp Service Life	75 YR		Substr	y =	-0.000293x	-0.107x	9.35		
Total Bridge Length (N49)	107 LF		Superstr	y =	-0.000450x	-0.164x	6.09		
Number of Spans (N45+N46)	3		Deck	y =	-0.000357x	-0.130x	7.67		
Skew Angle (N34)	26 DEG								
Average Elevation	6930 FT								
Max Pier Height	19 FT					Notes:			
* Amount of Widening for Bridge	4.50 FT		*Input 0 if no widening. Input	t should include widening on both sides of		1. Widenin	g is intend	ed only to corre	ct lane and/
Revised Deck Area (Bridge Replace)	4837 FT		bridge if applicable.			shoulder wi	idth defici	encies. It is not	intended fo
**Scour Critical Rating (N113)	N/A		**If scour critical rating is 3 or	r lower, Option 2 should consider the		adding traff	ic capacity	(i.e. adding gen	neral purpos
			implementation of scour cou	ntermeasures.		lanes).			
ost Multipliers				L to # Span Multiplier	•		Skew M	ultiplier	
Elevation > 4000ft	6930	1.25		L/#Span Ratio	Multiplier		Skew	Multiplier	
Pier Height > 30ft	19	1.00		=>100	1.00		<30	1.00	
Length to # span ratio	35.67	1.25		=>60	1.10		=>30	1.10	
Skew > 30degrees	26.00	1.00		<60	1.25				
roject Cost Multiplier	All Options	2.20							
djusted Bridge Replace Cost			Elevation Multiplier			Pier H Mult	iplier		
Dana Daidan Dandananant Cost (Dan CE)	Ć42E 00		Elev	Multiplier		Pier H	Multiplie	er er	
Base Bridge Replacement Cost (Per SF)	\$125.00		<4000	1.00		<30	1.00		
ridge Replacement Cost w/ Multipliers	Ć10F 34		=>4000	1.25		=>30	1.10		
(Per SF)	\$195.31								
					User input cell				
					Only manipulate cell val	ue after consulti	ng with te	am	

			Bridge I	History (Inspections/A	s-builts)				
			Description					Category	Year
Original co	nstruction I-40-4(20)								1966
Barrier rep	lacement I-40-4(123)								1992
Major colu	mn wall fill-in construction p	erformed.					Re	ehab (Substr)	2003
Latest insp	ection does not reveal any u	nusual activity in deck	/superstructure - perfo	orm rehab on both super	structure/deck ir	n option 2.			

Replace / Rehab / Repair Inform	nation			
BRIDGE DECK ITEM	DESCRIPTION	LINIT COST (Dow SE)	LIFE (VDC)	RATING BENEFIT
		UNIT COST (Per SF)	LIFE (YRS)	
Replace (Deck)	Full Deck Replacement	\$97.66	25	Rating = 8
Rehab (Deck Concrete Overlay)	Overlay (Concrete)	\$10.00	15	+ 2
Rehab (Deck Epoxy Overlay)	Overlay (Epoxy)	\$5.00	10	+1
Repair (Deck)	Patch Spalls / Seal Cracks	\$3.00	See Deterioration Slope	+0
Replace (Bridge)	Full Bridge Replacement	\$195.31	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	\$3.00	20	+0
Repair (After Rehab)	Patch Spalls / Seal Cracks	\$3.00	10	+0
SUPERSTRUCTURE - STEEL				
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Supr - Stl)	Full SuperStr Replacement	\$97.66	50	Rating = 8
Rehab (Supr - Stl)	Weld New Structural Components	\$48.83	15	+2
Repair (Supr - Stl)	Weld Repair / Crack Relief	\$5.00	See Deterioration Slope	+1
SUPERSTRUCTURE - CONCRETE				
ITEM	DESCRIPTION	LINIT COST (Downs)	LIEF (VDC)	RATING BENEFIT
		UNIT COST (Per SF)	LIFE (YRS)	
Replace (Supr - Conc)	Full SuperStr Replacement	\$97.66 \$48.83	50 15	Rating = 8 + 2
Rehab (Supr - Conc)	Replace Structural Component			
Repair (Supr - Conc)	Patch Spalls / Seal Cracks	\$5.00	See Deterioration Slope	+1
Replace (Bridge)	Full Bridge Replacement	\$195.31	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	\$3.00	20	+1
Repair (After Rehab)	Patch Spalls / Seal Cracks	\$3.00	10	+1
SUBSTRUCTURE - STRUCTURAL				
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Substr)	Full SubStr Replacement	\$97.66	75	Rating = 8
Rehab (Substr)	Replace Structural Component	\$48.83	50	+2
Repair (Substr)	Patch Spalls / Seal Cracks	\$5.00	See Deterioration Slope	+1
CURCIDILATION COUR				
SUBSTRUCTURE - SCOUR	DECEDITION	LINUT COCT (Descent)	LIEF (VDC)	DATING DENIERS
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Rehab (Substr - Scour)	Add scour protection slabs	\$48.83	50	+2
Repair (Substr - Scour)	Patch Spalls / Seal Cracks	\$5.00	See Deterioration Slope	+1
Replace (Bridge)	Full Bridge Replacement	\$195.31	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	\$3.00	20	+1
Repair (After Rehab)	Patch Spalls / Seal Cracks	\$3.00	10	+1

ntion 1 -		OP (#1180) / I-40 / N Bridge Now	130.20																			
puon 1 -	webiace B	mage NOW		Notes:											Dete	erioration Line Equa	ation					
Bridge D	eck Area =	4355 SF			ear" column me	eans current b	ridge is nea	aring the end of its expected servi	ce life.					Item	Slope =	Days	Years	Year Drop				
	eck Area =	4837 SF						replacement should be selected a						Substr	y =	_	-0.107x	9.35				
	/ear Built =	1966						during replacement.						Superstr	y =		-0.164x	6.09				
	rvice Life =	75 YR		Widened de									-	Deck	y =		-0.130x	7.67				
rvh 26		75111						deck deterioration of 1 point every	v 20 vears					DCCK	у –	5.50035/A	5.130A	7.07				
				2pair ucck	,	,c, srioulu	, a		, , cuis.													
	Substructure						Superstruc						<u>Deck</u>							Summary		
Year	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Minimum Rating	Total Cost Per Year (2015 \$ raw costs)	Present Value at 3%	Present Valu
2015	6						5		· _				5						_			
2016 2017	6						5 5						5 5									
2018	6	No Rehab/Repair V	ork Can Be D	Oone. Not Yet In 5	-Year Program	n.	5	No Rehab/Repair Wo	rk Can Be D	one. Not Yet In 5	-Year Program.		5	No Rehab/Repair Wo	ork Can Be D	one. Not Yet In 5-Y	ear Program					
2019	6						5						5									
2020	6		·				5						5									
2021	8	Replace (Bridge)	\$195.31	\$944,616.82	75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	\$944,616.82	\$791,101.71	\$629,438
2022 2023	8						8						8						8			
2023	8						8						8						8			
2025	8						8						8						8			
2026	8						8						8						8			
2027	8						8						8						8			
2028	8						8						8						8			
2029	8						8						8						8			
2030	8						8						8						8			
2031	7						7						7						7			
2032	7						7						7						7			
2033	7						7						7						7			
2034	7						7						7						7			
2035	7 7						,						7						7			
2036 2037	7						7						7						7			
2037	7						7						7						7			
2038	7						7						7						7			
2040	6						6						6						6			
2041	7 F	Repair (After Bridge Replace)	\$3.00	\$14,509.50	20	+1	7	Repair (After Bridge Replace)	\$3.00	\$14,509.50	20	+1	7	Repair (After Bridge Replace)	\$3.00	\$14,509.50	20	+0	7	\$43,528.50	\$20,183.94	\$7,495.
2042	7						7						7						7			
2043	7						7						7						7			
2044	7						7						7						7			
2045	7						7						7						7			
2046 2047	7						7						7						7			
2047	7						7						7						7			
2048	7						7						7						7			
2050	7						7						7						7			
2051	6						6						6						6			
2052	6						6						6						6			
2053	6						6						6						6			
2054	6						6						6						6			
2055	6						6						6						6			
2056	6						6						6						6			
2057	6						6						6						6			
2058 2059	6						6						6						6			
2060	5						5						5						5			
2061	6 F	Repair (After Bridge Replace)	\$3.00	\$14,509.50	20	+1	6	Repair (After Bridge Replace)	\$3.00	\$14,509.50	20	+1	6	Repair (After Bridge Replace)	\$3.00	\$14,509.50	20	+0	6	\$43,528.50	\$11,175.36	\$1,936.
2062	6	, , , , ,					6						6	, , , ,					6			
2063	6						6						6						6			
2064	6						6						6						6			
2065	6						6						6						6			
2066	6						6						6						6			
2067	6						6						6						6			
1068	6						6						6						6			
2069 2070	5						5						5						6 5			
2070	5						5						5						5			
2072	5						5						5						5			
2073	5						5						5						5			
2074	5						5						5						5			
	5						5						5						5			
2075	5						5						5						5			
2075 2076	5						5						5						5			
2075 2076 2077	_						5						5						5			
2075 2076 2077 2078	5						5						5 5						5			
2075 2076 2077 2078 2079	5						5						5						5 Total Cost =	\$1,031,673.82	\$822,461.00	\$638,87
2075 2076 2077 2078 2079	5 5 5																		. Juan CUSL -	31,031,073.02	2022, <del>4</del> 01.00	2020,870
2075 2076 2077	5 5																					
2075 2076 2077 2078 2079 2080	5 5																	Ave	erage Rating =			
2075 2076 2077 2078 2079	5 5 5																	Ave	erage Rating = End Rating =			
2075 2076 2077 2078 2079 2080	5 5																	Ave				

The content of the	The state   1	1. Red fill in "Year" column means current bridge is nearing the end of its expected service life.   Slope = Days   Years   Year Drop	Present V
State   Stat	13   13   13   13   13   13   13   13	1. Recall III   Year Coulum means current Origie is nearing the end of its expected service life.   Substr   y = -0.000293x   -0.107x   9.35	Present V
Second Column   Second Colum	Section   Sect	3. Deck Rehab does not account for any deck widening during replacement.  5. Repair deck (after bridge replace) should provide a deck deterioration of 1 point every 20 years. Repair (Deck) should maintain a "5" at that year.  6. For other repair items, the "+" value rating should be applied to improve the bridge rating's value for that year.  5. Supersturure  Cost (Per SF)  Cost (Total)  Service Life  Rating Increase  For SF)  No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.  Superstr  y = -0.000450x  y = -0.000450x  -0.164x  6.09  Deck  y = -0.000450x  -0.164x  6.09  Deck  y = -0.000450x  -0.164x  6.09  Cost (Per Cost (After bridge replace) should provide a deck deterioration of 1 point every 20 years. Repair (Deck) should maintain a "5" at that year.)  Deck  Summary  Summary  Fresent Value at 3%  Present Value at 3%  Presen	Present V
	Companies   Comp	75 YR 4. Widened deck area applies to bridge replacement only.  5. Repair deck (after bridge replace) should provide a deck deterioration of 1 point every 20 years. Repair (Deck) should maintain deck rating for life of repair, if the rating would otherwise drop a point (i.e., if the rating would drop from a "5" to a "4", Repair Deck would maintain a "5" at that year.)  6. For other repair items, the "+" value rating should be applied to improve the bridge rating's value for that year.  Superstructure  Deck  Summary  Total Cost (Per SF)  Cost (Total)  Service Life Rating Increase  Rating Increase  Rating Increase  No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.  Special Service Life Service Life Service Done. Not Yet In 5-Year Program.	Present V
Second Continue   Second Con	Second Control   Process	5. Repair deck (after bridge replace) should provide a deck deterioration of 1 point every 20 years. Repair (Deck) should maintain deck rating for  I life of repair, if the rating would otherwise drop a point (i.e., if the rating would drop from a "5" to a "4", Repair Deck would maintain a "5" at that year.)  6. For other repair items, the "+" value rating should be applied to improve the bridge rating's value for that year.  Superstructure  Cost (Per SF)  Cost (Total)  Service Life  Rating Increase  Rating Increase  Summary  Total Cost Per SF)  No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.  Sometimes of the strain of the s	Present V
Companies   Comp	Character   Char	life of repair, if the rating would otherwise drop a point (i.e., if the rating would drop from a "5" to a "4", Repair Deck would maintain a "5" at that year.)  6. For other repair items, the "+" value rating should be applied to improve the bridge rating's value for that year.    Superstructre	Present V
State   Stat	Control   Cont	6. For other repair items, the "+" value rating should be applied to improve the bridge rating's value for that year.    Superstructure	Present V
Part	Mart   18	Item  Cost (Per SF)  Cost (Total) Service Life   Rating Increase	Present V
Part	Mart   18	Item  Cost (Per SF)  Cost (Total) Service Life   Rating Increase	Present V
The control of the	The content of the	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.  SF) Cost (Total) Service the Increase Rating (2015 \$raw costs) Present value at 5% P	Present v
	International Control	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.  S No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.  S No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.  S No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.	
Part	Second Content	No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.  S  No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.  S  No Rehab/Repair Work Can Be Done. Not Yet In 5-Year Program.	
	Column   C	5	
2	Major Salada   Majo	5	
1	The participant   The partic		\$170,
Column   C	The control of the		
Second Control   Seco	Company   Comp		
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Second Process   Seco	The content of the		
Second Content			
S	Society   Soci	6 Repair (After Rehab) \$3.00 \$13,065.00 10 +1 6 Repair (After Rehab) \$3.00 \$13,065.00 10 +0 5 \$26,130.00 \$13,239.86	\$5,5
Second   S	Second   S		\$4,0
A	1		\$4,0 \$162,
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8	1		
1	7 7 8 9 1 7 7 8		
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Sepair   After Bridge Replace   Sepair   After Bridge Replac	9 7 7 Repair (After Bridge Replace) 53.00 \$14,509.50 20 +1 7 Repair (After Bridge Replace) 53.00 \$14,509.50 20 +1 7 Repair (After Bridge Replace) 53.00 \$14,509.50 20 +1 7 Repair (After Bridge Replace) 53.00 \$14,509.50 20 +1 7 Repair (After Bridge Replace) 53.00 \$14,509.50 20 +0 7 7 \$43,528.50 \$11,175.36 \$51, 175.36 \$		
Secondary   Seco	6 Repair (After Bridge Replace) S3.00 S14,509.50 20 +1 7 Repair (After Bridge Replace) S3.00 S14,509.50 20 +1 7 Repair (After Bridge Replace) S3.00 S14,509.50 20 +0 7 S43,528.50 S11,175.36 S1, 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7		
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78 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	8 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6		
80 5 5 5 Total Cost = \$1,314,019.08 \$700,956.61 \$35	5 5 5 Total Cost = \$1,314,019.08 \$700,956.61 \$35.	6 6	
Total Cost = \$1,314,019.08 \$700,956.61 \$35  Average Rating = 6.27	Total Cost = \$1,314,019.08 \$700,956.61 \$35.  Average Rating = 6.27		
			\$352,
ents: End Rating = 5	nts:		
		End Rating = 5	

		Minimum Repairs Then	cpiace	Notes:										Dete	erioration Line Eq	uation	v				
	Deck Area =	4355 SF		1. Red fill in "Y	'ear" column n	neans current b	bridge is	nearing the end of its expected se	rvice life.				ltem	Slope =	Days	Years	Year Drop				
	Deck Area =	4837 SF						eck replacement should be selecte	d as well.				Substr	y =		-0.107x	9.35				
	Year Built =	1966	-					ning during replacement.					Superstr	y =		-0.164x	6.09				
Exp Ser	rvice Life =	75 YR	1	4. Widened de				nt only. le a deck deterioration of 1 point ev	ery 20vears	Renair (Deck) cl	nould maintain de	k rating for	Deck	y =	-0.000357x	-0.130x	7.67				
							-	a point (i.e., if the rating would dr				-									
								ld be applied to improve the bridge													
	Substructur	70					Superstr	tructura				<u>Deck</u>							Summanı		
	Substructur	<u>e</u>					Supersu	tructure	<u> </u>										<u>Summary</u>		
Year	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	g Item	Cost (Per SF)	Cost (Total)	Service Life	Rating ncrease Rating	ltem	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Minimum Rating	Total Cost Per Year (2015 \$ raw costs)	Present Value at 3%	Present Va
2015 2016	6						5 5					5 5									
2017	6	No Rehab/Repair V	Work Can Be I	Done. Not Yet In	5-Year Progran	n.	5	No Rehab/Repair V	Vork Can Be D	Oone. Not Yet In	5-Year Program.	5	No Rehab/Repair W	ork Can Be D	one. Not Yet In 5	-Year Program					
2018 2019	6						5 5					5									
2020	6						5					5									
2021	5						4					5						4			
2022	5						5	Repair (Supr - Conc)	\$5.00	\$21,775.00	6	+1 5						5	\$21,775.00	\$17,705.07	\$13,56
2023 2024	5						5					5	Repair (Deck)	\$3.00	\$13,065.00	8	+0	5 5	\$13,065.00	\$10,313.63	\$7,603
2024	5						5					5						5			
2026	5						5					5						5			
2027	5						5					5						5			
2028	5						4				_	5						4	4		
2029 2030	5 4						5	Repair (Supr - Conc)	\$5.00	\$21,775.00	6	+1 5						5 4	\$21,775.00	\$14,395.84	\$8,44
2030	5	Repair (Substr)	\$5.00	\$21,775.00	9	+1	5					5						5	\$21,775.00	\$13,569.46	\$7,375
2032	5	(		. ,		_	5					5	Repair (Deck)	\$3.00	\$13,065.00	8	+0	5	\$13,065.00	\$7,904.54	\$4,13
033	5						5					5						5			
034	5						5					5						5 4			
035 036	5						4 5	Repair (Supr - Conc)	\$5.00	\$21,775.00	6	+1 5						- 4 - 5	\$21,775.00	\$11,705.14	\$5,25
037	5						5	nepair (Supr - Colle)	الاندر	γε1,773.00	U	5						5	ÇL1,773.UU	ÿ11,703.14	33,250
038	5						5					5						5			
039	4			40:			5					5			416	_		4	,		
)40 )41	5	Repair (Substr)	\$5.00 \$195.31	\$21,775.00	9 75	+1	5	Poplace (Priday)			75	5 ating = 8 8	Repair (Deck)	\$3.00	\$13,065.00	8 75	+0	5 8	\$34,840.00	\$16,639.78	\$6,41 \$162,6
)41	8	Replace (Bridge)	\$132.31	\$944,616.82	75	Rating = 8	8	Replace (Bridge)			/5	ating = 8 8	Replace (Bridge)			75	Rating = 8	8	\$944,616.82	\$438,013.84	\$162,6
043	8						8					8						8			
044	8						8					8						8			
045	8						8					8						8			
046 047	8						8					8						8			
048	8						8					8						8			
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2050	8						8					8						8			
2051 2052	7						7					7						7			
052	7						7					7						7			
054	7						7					7						7			
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057 058	7						7					7						7			
)58 )59	7						7					7						7			
060	6						6					6						6			
061	7	Repair (After Bridge Replace)	\$3.00	\$14,509.50	20	+1	7	Repair (After Bridge Replace)	\$3.00	\$14,509.50	20	+1 7	Repair (After Bridge Replace)	\$3.00	\$14,509.50	20	+0	7	\$43,528.50	\$11,175.36	\$1,93
162	7						7					7						7			
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063 064 065 066 067 068 069 070 071 072 073 074 075 076 077 078 079	7 7 7 7 7 7 7 6 6 6 6 6 6 6 6 6 6 6 5						7 7 7 6 6 6 6 6 6 6 6 6 5											6 6 6 6 6 6 6 5 Total Cost =	\$1,136,215.32	\$541,422.65	\$217,3
063 064 065 066 066 067 068 069 071 072 073 074 075 076 077 078 079 080	7 7 7 7 7 7 7 6 6 6 6 6 6 6 6 6 6 5						7 7 7 6 6 6 6 6 6 6 6 6 5											6 6 6 6 6 6 5 Total Cost =	6.22	\$541,422.65	\$217,5
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663 664 665 666 667 668 669 700 711 722 733 744 755 766 777 788 799 880	7 7 7 7 7 7 7 7 6 6 6 6 6 6 6 6 6 6 5						7 7 7 6 6 6 6 6 6 6 6 5											6 6 6 6 6 6 5 Total Cost =	6.22	\$541,422.65	\$217,

### LONE TREE RD EB OP (#1180) / I-40 / MP 196.26 OST COMPARISON Present Value 2015 Dollars - Raw Costs COST COMPARISON Present Value 2015 Dollars - Fully Loaded Costs Comparison to Replacement AGENCY COST 3% 7% OPTION AGENCY COST 3% 7% OPTION Option Agency Cost 3% 7% Option 1 (Replace) | \$ 1,031,673.82 \$822,461.00 \$638,870.44 2 (Rehab) 78.51% 117.33% 181.39% Option 1 (Replace) \$2,269,682 \$1,809,414 \$1,405,515 151.91% 293.88% Option 2 (Rehab) \$ 1,314,019.08 \$700,956.61 \$352,208.45 90.80% Option 2 (Rehab) \$2,890,842 \$1,542,105 \$774,859 3 (Repair) \$541,422.65 Option 3 (Repair) | \$ 1,136,215.32 \$217,394.94 Option 3 (Repair) \$2,499,674 \$1,191,130 \$478,269 Bridge Ratings Per Option AVG RATING **END RATING** OPTION Option 1 (Replace) 6.45 6.27 5 Option 2 (Rehab) 6.22 5 Option 3 (Repair) **COST COMPARISON RATING COMPARISON** \$1,400,000.00 \$1,200,000.00 Option 1 - Replace Bridge Now \$1,000,000.00 Option 2 - Perform Bridge Rehabilitiation Then Present Value at 7% \$800,000.00 Replace ■ Present Value at 3% \$600,000.00 Option 3 - Perform Minimum Repairs Then ■ AGENCY COST Replace \$400,000.00 AGENCY COST \$200,000.00 Present Value at 3% Present Value at 7% Option 1 (Replace) Option 2 (Rehab) Option 3 (Repair)

Bridge Information			Deterioration Slope	·					
Bridge Deck Area (A225)	4355 SF		lt a	Deterioratio	n Line Equation		Year		
Year Built (N27)	1966		Item	Slope =	Days	Years	Drop		
Exp Service Life	75 YR		Substr	y =	-0.000433x	-0.158x	6.32		
Total Bridge Length (N49)	107 LF		Superstr	y =	-0.000519x	-0.189x	5.28		
Number of Spans (N45+N46)	3		Deck	y =	-0.000357x	-0.130x	7.67		
Skew Angle (N34)	27 DEG								
Average Elevation	6930 FT								
Max Pier Height	14 FT					Notes:			
* Amount of Widening for Bridge	4.50 FT		*Input 0 if no widening. Inpu	ut should include widening on both sides of		1. Widening	g is intend	ed only to correct	lane and/o
Revised Deck Area (Bridge Replace)	4837 FT		bridge if applicable.			shoulder wi	dth deficie	encies. It is not in	tended for
**Scour Critical Rating (N113)	N/A		**If scour critical rating is 3	or lower, Option 2 should consider the		adding traff	ic capacity	(i.e. adding gene	ral purpose
			implementation of scour co	untermeasures.		lanes).			
Cost Multipliers				L to # Span Multiplier			Skew Mu	ıltinligr	
Elevation > 4000ft	6930	1.25		L/#Span Ratio	Multiplier		Skew	Multiplier	
Pier Height > 30ft	14	1.00		=>100	1.00		<30	1.00	
Length to # span ratio	35.67	1.25		=>60	1.10		=>30	1.10	
Skew > 30degrees	27.00	1.00		<60	1.25		->30	1.10	
Project Cost Multiplier	All Options	2.20		100	1.25				
roject cost wartiprier	All Options	2.20							
Adjusted Bridge Replace Cost			Elevation Multiplier			Pier H Multi	plier		
	¢425.00		Elev	Multiplier		Pier H	Multiplie	er	
Base Bridge Replacement Cost (Per SF)	\$125.00		<4000	1.00		<30	1.00		
Bridge Replacement Cost w/ Multipliers	Ć105 21		=>4000	1.25		=>30	1.10		
(Per SF)	\$195.31								
					User input cell				
					Only manipulate cell va	lue after consulti	na with to	am .	

Bridge History (Inspections/As-builts)						
Description	Category	Year				
Original construction I-40-4(20)		1966				
Barrier replacement I-40-4(131)		1992				
Major column wall fill-in construction performed.	Rehab (Substr)	2003				
Latest inspection does not reveal any unusual activity in deck/superstructure - perform rehab on both superstructure/deck in option 2.						

Replace / Rehab / Repair Inform	nation			
BRIDGE DECK ITEM	DESCRIPTION	LINIT COST (Dow SE)	LIFE (VDC)	RATING BENEFIT
		UNIT COST (Per SF)	LIFE (YRS)	
Replace (Deck)	Full Deck Replacement	\$97.66	25	Rating = 8
Rehab (Deck Concrete Overlay)	Overlay (Concrete)	\$10.00	15	+ 2
Rehab (Deck Epoxy Overlay)	Overlay (Epoxy)	\$5.00	10	+1
Repair (Deck)	Patch Spalls / Seal Cracks	\$3.00	See Deterioration Slope	+0
Replace (Bridge)	Full Bridge Replacement	\$195.31	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	\$3.00	20	+0
Repair (After Rehab)	Patch Spalls / Seal Cracks	\$3.00	10	+0
SUPERSTRUCTURE - STEEL				
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Supr - Stl)	Full SuperStr Replacement	\$97.66	50	Rating = 8
Rehab (Supr - Stl)	Weld New Structural Components	\$48.83	15	+2
Repair (Supr - Stl)	Weld Repair / Crack Relief	\$5.00	See Deterioration Slope	+1
SUPERSTRUCTURE - CONCRETE				
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Supr - Conc)	Full SuperStr Replacement	\$97.66	50	Rating = 8
Rehab (Supr - Conc)	Replace Structural Component	\$48.83	15	+2
Repair (Supr - Conc)	Patch Spalls / Seal Cracks	\$5.00	See Deterioration Slope	+1
Replace (Bridge)	Full Bridge Replacement	\$195.31	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	\$3.00	20	+1
Repair (After Rehab)	Patch Spalls / Seal Cracks	\$3.00	10	+1
		Ţ.		_
SUBSTRUCTURE - STRUCTURAL				
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Substr)	Full SubStr Replacement	\$97.66	75	Rating = 8
Rehab (Substr)	Replace Structural Component	\$48.83	50	+2
Repair (Substr)	Patch Spalls / Seal Cracks	\$5.00	See Deterioration Slope	+1
CLIDCEDILICELINE COOLIN				
SUBSTRUCTURE - SCOUR	DECORPTION	LINUT COCT (D. CT)	LIEF (VOC)	DATING DENIETE
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Rehab (Substr - Scour)	Add scour protection slabs	\$48.83	50	+2
Repair (Substr - Scour)	Patch Spalls / Seal Cracks	\$5.00	See Deterioration Slope	+1
Replace (Bridge)	Full Bridge Replacement	\$195.31	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	\$3.00	20	+1
Repair (After Rehab)	Patch Spalls / Seal Cracks	\$3.00	10	+1

		3 OP (#1181) / I-40 / I Bridge Now																				
Prion I -	cpiace D			Notes:											Dete	erioration Line Equa	ation					
Bridge D	eck Area =	4355 SF			ear" column m	eans current b	ridge is ne	earing the end of its expected servi	ice life.					Item	Slope =	Days	Years	Year Drop				
	eck Area =	4837 SF						k replacement should be selected						Substr	y =	_	-0.158x	6.32	ĺ			
	/ear Built =	1966						g during replacement.						Superstr	y =		-0.189x	5.28	l			
	rvice Life =	75 YR		Widened de									-	Deck	y =		-0.130x	7.67				
בילי זכו		75111						only. a deck deterioration of 1 point ever	rv 20 vears					DCCK	у –	5.50035/A	5.130A	7.07				
					,	,, siroulu	,u		, , ca.s.													
i	Substructure						Superstruc						<u>Deck</u>							Summary		
Year	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Minimum Rating	Total Cost Per Year (2015 \$ raw costs)	Present Value at 3%	Present Valu
2015	6						5						5		·				Ū			
2016 2017	6						5 5						5 5									
2018	6	No Rehab/Repair W	ork Can Be D	Oone. Not Yet In 5	5-Year Program	1.	5	No Rehab/Repair Wo	ork Can Be D	one. Not Yet In 5	-Year Program.		5	No Rehab/Repair W	ork Can Be D	one. Not Yet In 5-Y	ear Program					
2019	6						5						5									
2020	6						5						5									
2021	8	Replace (Bridge)	\$195.31	\$944,616.82	75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	\$944,616.82	\$791,101.71	\$629,438
2022 2023	8						8						8						8			
2024	8						8						8						8			
2025	8						8						8						8			
2026	8						8						8						8			
2027	8						8						8						8			
2028	8						8						8						8			
2029	8						8						8						8			
2030	8						8						8						8			
2031	7						7						7						7			
2032	7						7						7						7			
2033	7					-	7						7						7			
2034 2035	7						7						7						7			
2035	7						7						7						7			
2036	7						7						7						7			
2037	7						7						7						7			
2039	7						7						7						7			
2040	6						6						6						6			
2041	7 I	Repair (After Bridge Replace)	\$3.00	\$14,509.50	20	+1	7	Repair (After Bridge Replace)	\$3.00	\$14,509.50	20	+1	7	Repair (After Bridge Replace)	\$3.00	\$14,509.50	20	+0	7	\$43,528.50	\$20,183.94	\$7,495.
2042	7						7						7						7			
2043	7						7						7						7			
2044	7						7						7						7			
2045	7						7						7						7			
2046 2047	7						7						7						7			
2047	7						7						7						7			
2048	7						7						7						7			
2050	7						7						7						7			
2051	6						6						6						6			
2052	6						6						6						6			
2053	6						6						6						6			
2054	6						6						6						6			
2055	6						6						6						6			
2056	6						6						6						6			
2057	6						6						6						6			
2058 2059	6					-	6						6						6			
2060	5						5						5						5			
2061	6 I	Repair (After Bridge Replace)	\$3.00	\$14,509.50	20	+1	6	Repair (After Bridge Replace)	\$3.00	\$14,509.50	20	+1	6	Repair (After Bridge Replace)	\$3.00	\$14,509.50	20	+0	6	\$43,528.50	\$11,175.36	\$1,936
2062	6						6						6						6			
2063	6						6						6						6			
2064	6						6						6						6			
2065	6						6						6						6			
2066	6						6						6						6			
2067	6					-	6						6						6			
2068 2069	6						6						6						6			
2009	5						5						5						5			
2071	5						5						5						5	1		
2072	5						5						5						5			
	5						5						5						5			
2073	5						5						5						5			
2073 2074	5						5						5						5			
2073 2074 2075	_						5						5						5			
2073 2074 2075 2076	5						5						5						5 5			
2073 2074 2075 2076 2077	5					-	5 5						5 5						5			
2073 2074 2075 2076 2077 2078	5 5 5					1	5						5						5			
2073 2074 2075 2076 2077 2078 2079	5 5 5 5																					
2073 2074 2075 2076 2077 2078	5 5 5 5 5																		Total Cost =	\$1,031,673.82	\$822,461.00	\$638,87
2073 2074 2075 2076 2077 2078 2079	5 5 5 5 5																				\$822,461.00	\$638,87
2073 2074 2075 2076 2077 2078 2079 2080	5 5 5 5 5																		erage Rating =	6.45	\$822,461.00	\$638,87
2073 2074 2075 2076 2077 2078 2079	5 5 5 5																			6.45	\$822,461.00	\$638,87

	LONE TRE	E RD W	B OP (#1181) / I-40 / N	MP 196.2	26																	
			Bridge Rehabilitiation Th		ce																	
	Bridge De	eck Area =	4355 SF		Notes:	/ear" column means current	hridge is no	earing the end of its expected ser	vice life					ltem	Dete Slope =	erioration Line Eq Days	uation Years	Year Drop				
		eck Area =			2. When super	rstructure replacement is se	lected, dec	k replacement should be selected						Substr	у =		-0.158x	6.32				
		ear Built =	1966			does not account for any de								Superstr	y =		-0.189x	5.28				
	Exp Ser	vice Life =	75 YR	1		eck area applies to bridge re ( (after bridge replace) shou		tonly. a deck deterioration of 1 point eve	ery 20 vears. R	Repair (Deck) sh	ould maintain o	leck rating fo	r	Deck	y =	-0.000357x	-0.130x	7.67	1			
					life of repai	ir, if the rating would othen	vise drop a	point (i.e., if the rating would dro	p from a "5" to	o a "4", Repair 🛭												
					6. For other re	pair items, the "+" value rat	ing should l	be applied to improve the bridge	rating's value	for that year.												
		Substructur	re				Superstru	ıcture					Deck							Summary		
				Cost (Per		Rating			Cost (Per			Rating			Cost (Per			Rating	Minimum	Total Cost Per Year		
	Year	Rating	Item	SF)	Cost (Total)	Service Life Increase	Rating	Item	SF)	Cost (Total)	Service Life	Increase	Rating	Item	SF)	Cost (Total)	Service Life	Increase	Rating	(2015 \$ raw costs)	Present Value at 3%	Present Value at 7%
0	2015	6					5						5									
1	2016	6					5						5									
3	2017 2018	6	No Rehab/Repair W	ork Can Be	Done. Not Yet In !	5-Year Program.	5	No Rehab/Repair W	ork Can Be Do	ne. Not Yet In 5	-Year Program.		5 5	No Rehab/Repair Wo	ork Can Be D	Oone. Not Yet In 5	5-Year Progran	1.				
4	2019	6					5						5									
5 6	2020 2021	6			1		7	Rehab (Supr - Conc)	\$48.83	\$212,643.76	15	+ 2	5 7	Rehab (Deck Concrete Overlay)	\$10.00	\$43,550.00	15	+2	5	\$256,193.76	\$214,558.24	\$170,712.72
7	2021	5					7	nenab (supi - cone)	ŷ+0.03	YE12,043.70	13		7	(Deck college ovellay)	Ç10.00	Ç-5,550.00	15		5	9230,133.70	7217,JJ0.24	Ş110,112.12
8	2023	5					7						7						5			
9 10	2024 2025	5					7						7						5 5			
11	2026	5					7						7						5			
12	2027 2028	4	Pannin/Sub-tul	ČE OO	\$21 77F 00	6 +1	7						7						4 5	\$21,775.00	\$14,827.72	\$9,035.85
13 14	2028	5	Repair (Substr)	\$5.00	\$21,775.00	6 +1	6						6						5	\$21,775.UU	\$14,827.72	ζδ.Cε∪,Ε¢
15	2030	5					6						6						5			
16 17	2031 2032	5					6						6						5			
18	2033	5					6						6						5			
19	2034	4			4		6						6						4			
20 21	2035 2036	5	Repair (Substr)	\$5.00	\$21,775.00	6 +1	6						6						5 5	\$21,775.00	\$12,056.29	\$5,627.07
22	2037	5					5						5						5			
23	2038	5					6	Repair (After Rehab)	\$3.00	\$13,065.00	10	+1	6	Repair (After Rehab)	\$3.00	\$13,065.00	10	+0	5	\$26,130.00	\$13,239.86	\$5,512.04
24 25	2039 2040	5 5					6						6						5 5			
26	2041	8	Replace (Bridge)	\$195.31	\$944,616.82	75 Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	\$944,616.82	\$438,013.84	\$162,658.76
27	2042	8					8						8						8			
28 29	2043 2044	8					8 8						8						8			
30	2045	8					8						8						8			
31 32	2046 2047	8					8						8						8			
33	2047	8					8						8						8			
34	2049	8					8						8						8			
35 36	2050 2051	8 7					8 7						8						8			
37	2052	7					7						7						7			
38	2053	7					7						7						7			
39 40	2054 2055	7					7						7						7			
41	2056	7					7						7						7			
42	2057	7					7						7						7			
43 44	2058 2059	7					7						7						7			
45	2060	6					6						6						6			
46 47	2061 2062	7	Repair (After Bridge Replace)	\$3.00	\$14,509.50	20 + 1	7 7	Repair (After Bridge Replace)	\$3.00	\$14,509.50	20	+1	7	Repair (After Bridge Replace)	\$3.00	\$14,509.50	20	+0	7	\$43,528.50	\$11,175.36	\$1,936.96
48	2063	7					7						7						7			
49	2064	7					7						7						7			
50 51	2065 2066	7					7						7						7			
52	2067	7					7						7						7			
53 54	2068	7					7						7						7			
54 55	2069 2070	7					7						7						7			
56	2071	6					6						6						6			
57 58	2072 2073	6					6						6						6			
58	2073	6					6						6						6			
60	2075	6					6						6						6			
61 62	2076 2077	6					6						6						6			
63	2078	6					6						6						6			
64	2079	6					6						6						6			
65	2080	5					5						5						5 Total Cost =	\$1,314,019.08	\$703,871.30	\$355,483.40
																					7:,0, 2:00	,, 155115
	Commenter																	Av	erage Rating = End Rating =	6.27 5		
	Comments:																		ciiu Kating =	5		
							1															

	LONE TRE	E RD WE	B OP (#1181) / I-40 / N	MP 196.2	26																		
	Option 3 -	Perform I	Minimum Repairs Then R	Replace	Natara																		
	Bridge De	eck Area =	4355 SF		Notes: 1. Red fill in "Y	'ear" column mea	ans current br	idge is near	ing the end of its expected ser	vice life.					ltem	Slope =	erioration Line Ed Days	years Years	Year Drop				
		eck Area =	4837 SF						eplacement should be selected	l as well.					Substr	y =	-0.000433x	-0.158x	6.32				
		ear Built = vice Life =	1966 75 YR			does not account eck area applies t			uring replacement. ly.						Superstr Deck	y = y =		-0.189x -0.130x	5.28 7.67				
	,				5. Repair deck	(after bridge rep	olace) should	provide a de	eck deterioration of 1 point eve						-	,							
									int (i.e., if the rating would dro applied to improve the bridge			Deck would mai	ntain a "5" at	that year.									
	<u> </u>	Substructure	<u>e</u>					uperstructu	<u>rre</u>					<u>Deck</u>							Summary		
	Year	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Minimum Rating	Total Cost Per Year (2015 \$ raw costs)	Present Value at 3%	Present Value at 7%
0	2015	6			<u> </u>	ļļ.		5			]			5						0	,		
1	2016	6						5						5									
3	2017 2018	6	No Rehab/Repair W	ork Can Be I	Done. Not Yet In 5	5-Year Program.		5	No Rehab/Repair W	ork Can Be I	Oone. Not Yet In 5	5-Year Program.		5 5	No Rehab/Repair We	ork Can Be D	Oone. Not Yet In 5	5-Year Program	1.				
4	2019	6						5						5									
5 6	2020 2021	6 5						5 4						5						4			
7	2022	5						5	Repair (Supr - Conc)	\$5.00	\$21,775.00	5	+1	5						5	\$21,775.00	\$17,705.07	\$13,560.38
8 9	2023 2024	5 5						5						5 5	Repair (Deck)	\$3.00	\$13,065.00	8	+0	5	\$13,065.00	\$10,313.63	\$7,603.95
10	2025	5						5						5						5			
11 12	2026 2027	5 4						5 4						5 5						5 4			
13	2028	5	Repair (Substr)	\$5.00	\$21,775.00	6	+1	5	Repair (Supr - Conc)	\$5.00	\$21,775.00	5	+ 1	5						5	\$43,550.00	\$29,655.43	\$18,071.70
14	2029 2030	5						5						5						5			
15 16	2031	5						5						5	Repair (Deck)	\$3.00	\$13,065.00	8	+0	5	\$13,065.00	\$8,141.68	\$4,425.57
17	2032	5						5						5						5 4			
18 19	2033 2034	4						5	Repair (Supr - Conc)	\$5.00	\$21,775.00	5	+1	5 5						4	\$21,775.00	\$12,417.98	\$6,020.97
20	2035	5	Repair (Substr)	\$5.00	\$21,775.00	6	+1	5						5						5	\$21,775.00	\$12,056.29	\$5,627.07
21 22	2036 2037	5 5						5 5						5 5						5			
23	2038	5						5						5						5			
24 25	2039 2040	5 5						4 5	Repair (Supr - Conc)	\$5.00	\$21,775.00	5	+1	5 5	Repair (Deck)	\$3.00	\$13,065.00	8	+0	4 5	\$13,065.00 \$21,775.00	\$6,427.11 \$10,399.86	\$2,575.72 \$4,012.03
26	2041	8	Replace (Bridge)	\$195.31	\$944,616.82	75	Rating = 8	8	Replace (Bridge)	φ5.00	Q21,775.00	75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	\$944,616.82	\$438,013.84	\$162,658.76
27 28	2042 2043	8						8						8						8			
29	2044	8						8						8						8			
30 31	2045 2046	8						8						8						8			
32	2047	8						8						8						8			
33 34	2048 2049	8						8						8						8			
35	2050	8						8						8						8			
36	2051	7						7						7						7			
37 38	2052 2053	7						7						7						7			
39 40	2054	7						7						7						7			
41	2055 2056	7						7						7						7			
42	2057	7						7						7						7			
43 44	2058 2059	7 7						7 7						7						7			
45	2060	6		40.00	444.000.00			6		40.00	4			6		40.00	4			6	4.0	444 400 00	44.000.00
46 47	2061 2062	7	Repair (After Bridge Replace)	\$3.00	\$14,509.50	20	+1	7	Repair (After Bridge Replace)	\$3.00	\$14,509.50	20	+1	7	Repair (After Bridge Replace)	\$3.00	\$14,509.50	20	+0	7	\$43,528.50	\$11,175.36	\$1,936.96
48	2063	7						7						7						7			
49 50	2064 2065	7 7						7 7						7						7			
51	2066	7						7						7						7			
52 53	2067 2068	7						7						7						7			
54	2069	7						7						7						7			
55 56	2070 2071	7 6						7						7						7 6			
57	2072	6						6						6						6			
58 59	2073 2074	6						6						6						6			
60	2075	6						6						6						6			
61 62	2076 2077	6						6						6						6			
63	2078	6						6						6						6			
64 65	2079 2080	6						6						6 5						6 5			
00	2000	5						J						3						Total Cost =	\$1,157,990.32	\$556,306.24	\$226,493.10
	Comments:																		AV	erage Rating = End Rating =	6.22 5		

#### LONE TREE RD WB OP (#1181) / I-40 / MP 196.26 OST COMPARISON Present Value 2015 Dollars - Raw Costs COST COMPARISON Present Value 2015 Dollars - Fully Loaded Costs Comparison to Replacement AGENCY COST 7% OPTION AGENCY COST 3% 7% OPTION 3% Option Agency Cost 3% 7% Option 1 (Replace) | \$ 1,031,673.82 \$822,461.00 \$638,870.44 2 (Rehab) 78.51% 116.85% 179.72% Option 1 (Replace) \$2,269,682 \$1,809,414 \$1,405,515 147.84% 282.07% Option 2 (Rehab) \$ 1,314,019.08 \$703,871.30 \$355,483.40 3 (Repair) 89.09% Option 2 (Rehab) \$2,890,842 \$1,548,517 \$782,063 Option 3 (Repair) \$ 1,157,990.32 \$556,306.24 \$226,493.10 Option 3 (Repair) \$2,547,579 \$1,223,874 \$498,285 Bridge Ratings Per Option AVG RATING **END RATING** OPTION Option 1 (Replace) 6.45 6.27 5 Option 2 (Rehab) 6.22 5 Option 3 (Repair) **COST COMPARISON RATING COMPARISON** \$1,400,000.00 \$1,200,000.00 Option 1 - Replace Bridge Now \$1,000,000.00 Option 2 - Perform Bridge Rehabilitiation Then Present Value at 7% \$800,000.00 Replace ■ Present Value at 3% \$600,000.00 Option 3 - Perform Minimum Repairs Then ■ AGENCY COST Replace \$400,000.00 AGENCY COST \$200,000.00 Present Value at 3% Present Value at 7% Option 1 (Replace) Option 2 (Rehab) Option 3 (Repair)

BUFFALO RANGE TI OP WB (#138	87) / I-40 / MP 2	25.05							
(,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,									
Bridge Information			Deterioration Slope	·					
Bridge Deck Area (A225)	4301 SF			Deterioratio	n Line Equation		Year		
Year Built (N27)	1970		Item	Slope =	Days	Years	Drop		
Exp Service Life	75 YR		Substr	y =	-0.000423x	-0.154x	6.48		
Total Bridge Length (N49)	107 LF		Superstr	y =	-0.000616x	-0.225x	4.45		
Number of Spans (N45+N46)	3		Deck	y =	-0.000384x	-0.140x	7.14		
Skew Angle (N34)	15 DEG								
Average Elevation	5712 FT								
Max Pier Height	17 FT					Notes:			
* Amount of Widening for Bridge	4 FT		*Input 0 if no widening. Inpu	ut should include widening on both sides of		1. Widenin	g is intend	led only to corre	ct lane and/o
Revised Deck Area (Bridge Replace)	4729 FT		bridge if applicable.			shoulder w	idth defici	encies. It is not	intended for
**Scour Critical Rating (N113)	N/A		**If scour critical rating is 3 o	or lower, Option 2 should consider the		adding traff	fic capacity	(i.e. adding ger	neral purpose
			implementation of scour co	untermeasures.		lanes).			
Cost Multipliers				L to # Span Multiplier			Skew M	ultiplier	
Elevation > 4000ft	5712	1.25		L/#Span Ratio	Multiplier		Skew	Multiplier	
Pier Height > 30ft	17	1.00		=>100	1.00		<30	1.00	
Length to # span ratio	35.67	1.25		=>60	1.10		=>30	1.10	
Skew > 30degrees	15.00	1.00		<60	1.25				
Project Cost Multiplier	All Options	2.20							
Adjusted Bridge Replace Cost			Elevation Multiplier			Pier H Mult	iplier		
Pasa Pridge Penlasement Cost (Per ST)	\$125.00		Elev	Multiplier		Pier H	Multiplie	er	
Base Bridge Replacement Cost (Per SF)	\$125.00		<4000	1.00		<30	1.00		
Bridge Replacement Cost w/ Multipliers	\$195.31		=>4000	1.25		=>30	1.10		
(Per SF)	Ž132°21								
					User input cell				
					Only manipulate cell val	ue after consulti	ing with te	am	

Bridge History (Inspections/As-builts)	
Description	Category Year
·	
Bridge originally built I-40-4(42).	1970
Parapets replaced IR-40-4(122).	Repair (Deck) 1992
Approach slabs removed/replaced I-040-D(1)P.	2001
Parapet/guardrail repair I-040-D(221)A.	Repair (Deck) 2013
Latest bridge inspection recommends "rehabilitate bridge deck."	

	Replace P	TI OP WB (#1387) / I- Bridge Now																				
P(1011 I -	epiace L			Notes:											Dete	erioration Line Equa	ation					
Bridge De	eck Area =	4301 SF			ear" column m	eans current b	ridge is ne	earing the end of its expected serv	ice life.					Item	Slope =	Days	Years	Year Drop				
	eck Area =	4729 SF						k replacement should be selected						Substr	y =		-0.154x	6.48				
	/ear Built =	1970						g during replacement.						Superstr	y =		-0.134x	4.45				
	rvice Life =	75 YR		Widened de										Deck	y – y =		-0.223x -0.140x	7.14				
rvh sei		73111						only. a deck deterioration of 1 point ever	ירע ארפיינים					DECV	y =	0.000304X	0.14UX	7.14				
				o. nepail ucuk	, ancer bridge II	-prace, siloulu	. p. oviue o	point eve	, 20 years.													
	Substructure	2					Superstru	<u>cture</u>					<u>Deck</u>							Summary		
Year	Rating	Item	Cost (Per	Cost (Total)	Service Life	Rating	Rating	Item	Cost (Per	Cost (Total)	Service Life	Rating	Rating	ltem	Cost (Per	Cost (Total)	Service Life	Rating	Minimum	Total Cost Per Year	Present Value at 3%	Present Valu
	_		SF)			Increase			SF)			Increase	_		SF)	,		Increase	Rating	(2015 \$ raw costs)		
2015 2016	6						5 5						5									
2017	6	No Rehab/Repair W	lork Can Bo D	Dona Not Vot In E	E. Voor Brogram	•	5	No Rehab/Repair Wo	ork Can Bo D	one Not Vet In E	- Voar Brogram		5	No Rehab/Repair Wo	ork Can Bo D	lone Not Vot In E.V	/oar Drogram					
2018	6	No Kenab/Kepan W	OIR Call be D	Jone. Not let iii J	J-Teal Flogram		5	Wo Kenab/Kepan WC	ork can be b	one. Not ret in s	- Teal Flogram.	•	5	No Kenaby Kepan W	OIK Call De D	one. Not retin 5-1	real Flogram	•				
2019	6						5						5									
2020	6	De de co (Dédec)	Ć405.24	¢022 620 00	75	Dall's a O	4	De aless (Didas)			75	D-1' 0	5	De dess (Dédes)			75	Dalling 0	0	¢022 €20 00	6772 540 04	6645.44
2021 2022	8	Replace (Bridge)	\$195.31	\$923,620.99	75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8 8	\$923,620.99	\$773,518.04	\$615,447
2022	8						8						8						8			
2024	8						8						8						8			
2025	8						8						8						8			
2026	8						8						8						8	1		
2027	8						8						8						8			
2028	8						8						8						8			
2029	8						8						8						8			
2030	8						8						8						8			
2030	7						7						7						7			
2032	7						7						7						7			
2032	7						7						7						7			
2033	7						7						7						7			
2035	7						7						7						7			
2036	7						7						7						7			
2037	7						7						7						7			
2037	7						7						7						7			
2038	7						7						7						7			
2040	6						6						6						6			
2040	7	Repair (After Bridge Replace)	\$3.00	\$14,187.00	20	+1	7	Repair (After Bridge Replace)	\$3.00	\$14,187.00	20	+ 1	7	Repair (After Bridge Replace)	\$3.00	\$14,187.00	20	+0	7	\$42,561.00	\$19,735.31	\$7,328
2041	7		<b>95.00</b>	Ç17,107.00	20	. 1	7	nepair (Arter Bridge Nepidte)	Ş5.00	717,107.00	20	. 1	7	nepair (Arter bridge nepidee)	<b>95.00</b>	Ç17,107.00	20	. 0	7	γ <del>-1</del> 2,301.00	15,735.31	.226,19
2042	7						7						7						7			
2043	7						7						7						7			
2045	7						7						7						7			
2046	7						7						7						7			
2047	7						7						7						7	İ		
2048	7						7						7						7			
2049	7						7						7						7			
2050	7						7						7						7			
2051	6						6						6						6	İ		
2052	6						6						6						6			
2053	6						6						6						6			
2054	6						6						6						6			
2055	6						6						6						6	İ		
2056	6						6						6						6			
2057	6						6						6						6			
2058	6						6						6						6			
2059	6						6						6						6			
2060	5						5						5						5			
2061	6	Repair (After Bridge Replace)	\$3.00	\$14,187.00	20	+ 1	6	Repair (After Bridge Replace)	\$3.00	\$14,187.00	20	+1	6	Repair (After Bridge Replace)	\$3.00	\$14,187.00	20	+0	6	\$42,561.00	\$10,926.96	\$1,893
2062	6						6						6						6			
2063	6						6						6						6			
064	6						6						6						6			
:065	6						6						6						6			
2066	6						6						6						6			
067	6						6						6						6			
2068	6						6						6						6			
2069	6						6						6						6			
2070	5						5						5						5			
2071	5						5						5						5			
2072	5						5						5						5			
073	5						5						5						5			
	5					1	5						5						5			
2074	5						5						5						5			
2074 2075							5						5						5			
2074 2075 2076	5						5						5						5			
2074 2075 2076 2077	5 5					1	5						5						5			
2074 2075 2076 2077 2078	5 5 5						5						5						5			
2074 2075 2076 2077 2078 2079	5 5 5					1	5						5						5	<u>l</u>	<u>I</u>	
2074 2075 2076 2077 2078 2079	5 5 5 5 5																			44		
2074 2075 2076 2077 2078 2079	5 5 5 5 5																		Total Cost =	\$1,008,742.99	\$804,180.31	\$624,67
2074 2075 2076 2077 2078 2079 2080	5 5 5 5 5																				\$804,180.31	\$624,67
2074 2075 2076 2077 2078 2079 2080	5 5 5 5 5																	Ave	erage Rating =	6.45	\$804,180.31	\$624,67
2074 2075 2076 2077 2078 2079	5 5 5 5 5																	Ave		6.45	\$804,180.31	\$624,67

	BUFFALO	RANGE	TI OP WB (#1387) / I-4	10 / MP	225.05																	
	Option 2 -	Perform I	Bridge Rehabilitiation Th	en Repla																		
	Bridge De	eck Area =	4301 SF		Notes: 1. Red fill in "Y	'ear" column means current	bridge is n	nearing the end of its expected ser	vice life.					ltem	Slope =	erioration Line Eq Days	uation Years	Year Drop				
		eck Area =	4729 SF		2. When super	structure replacement is se	lected, dec	ck replacement should be selected						Substr	y =	-0.000423x	-0.154x	6.48				
		ear Built = vice Life =	1970 75 YR			does not account for any de eck area applies to bridge re								Superstr Deck	y = y =	-0.000616x -0.000384x	-0.225x -0.140x	4.45 7.14				
	EXPOSI	VICE LITE	75					a deck deterioration of 1 point eve	ery 20 years.	Repair (Deck) sh	nould maintain o	deck rating fo	or	Seat	,	0.00030 1/4	0.110%	7.1.				
								a point (i.e., if the rating would dro			Deck would mai	ntain a "5" at	that year.)	)								
					6. For other re	pair items, the "+" value rat	ing snould	be applied to improve the bridge	rating's value	e for that year.												
	9	Substructure	2				Superstru	ucture					Deck							Summary		
	Year	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	ltem	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Minimum Rating	Total Cost Per Year (2015 \$ raw costs)	Present Value at 3%	Present Value at 7%
0	2015	6					5 5						5									
2	2016 2017	6	No Dobob /Donoio M	lank Can Ba I	Dana Nat Vat la l	F. V Dunaman	5	Na Pakah /Pawai-114	D- D	Nat Vat In I	F. V D		5	No Dobob /Domois NA/	D- D	Nat Vat I. F	. V D					
3	2018	6	No Rehab/Repair W	ork Can be i	Done. Not Yet in :	5- Year Program.	5	No Rehab/Repair W	ork can be L	Jone. Not Yet in :	5- Tear Program.		5	No Rehab/Repair Wo	ork can be b	one. Not fet in 5	5- Tear Program	1.				
5	2019 2020	6					5 4						5									
6	2021	5					5	Repair (Supr - Conc)	\$5.00	\$21,505.00	4	+ 1	7	Rehab (Deck Concrete Overlay)	\$10.00	\$43,010.00	15	+2	5	\$64,515.00	\$54,030.30	\$42,989.07
7	2022 2023	5					5						7						5			
9	2023	5					5						7						5			
10	2025	5					4		4	40			7						4	<b>3</b>	4	4
11 12	2026 2027	5 4					5	Repair (Supr - Conc)	\$5.00	\$21,505.00	4	+1	7						5	\$21,505.00	\$15,535.67	\$10,216.87
13	2028	5	Repair (Substr)	\$5.00	\$21,505.00	6 +1	5						7						5	\$21,505.00	\$14,643.86	\$8,923.81
14	2029 2030	5					5						7						5			
15 16	2030	5					5	Repair (Supr - Conc)	\$5.00	\$21,505.00	4	+ 1	6						5	\$21,505.00	\$13,401.21	\$7,284.49
17	2032	5					5						6						5			
18 19	2033 2034	5 4					5						6						5			
20	2035	5	Repair (Substr)	\$5.00	\$21,505.00	6 +1	4						6						4	\$21,505.00	\$11,906.80	\$5,557.30
21	2036	5					5	Repair (Supr - Conc)	\$5.00	\$21,505.00	4	+ 1	6						5 5	\$21,505.00	\$11,560.00	\$5,193.74
22 23	2037 2038	5					5						5						5			
24	2039	5					5						5						5			
25 26	2040 2041	5					4	Repair (Supr - Conc)	\$5.00	\$21,505.00	4	+1	5						4	\$21,505.00	\$9,971.76	\$3,703.06
27	2042	5	Repair (Substr)	\$5.00	\$21,505.00	6 +1	5	nepair (Supi - Coric)	\$5.00	321,303.00	4	**	5						5	\$21,505.00	\$9,681.32	\$3,460.81
28	2043	5					5						5						5			
29 30	2044 2045	5 8	Replace (Bridge)	\$195.31	\$923,620.99	75 Rating = 8	5 8	Replace (Bridge)			75	Rating = 8	5 8	Replace (Bridge)			75	Rating = 8	5 8	\$923,620.99	\$380,519.62	\$121,333.43
31	2046	8	1, 111 ( 101,		1,		8	., ,					8	., (,					8	11. 17.	1,.	, ,
32	2047 2048	8					8						8						8			
33 34	2048	8					8						8						8			
35	2050	8					8						8						8			
36 37	2051 2052	8					8						8						8			
38	2053	8					8						8						8			
39 40	2054 2055	8					8						8						8			
41	2056	7					7						7						7			
42	2057	7					7						7						7			
43 44	2058 2059	7					7						7						7			
45	2060	7					7						7						7			
46 47	2061 2062	7					7						7						7			
48	2062	7					7						7						7			
49	2064	6	D	42.00	444.0000	20	6	D	40.00	A44.000.00			6	D /AG D	42.00	64440=00			6	442.501.00	60 700 17	64.44:0=
50 51	2065 2066	7	Repair (After Bridge Replace)	\$3.00	\$14,187.00	20 +1	7	Repair (After Bridge Replace)	\$3.00	\$14,187.00	20	+1	7	Repair (After Bridge Replace)	\$3.00	\$14,187.00	20	+0	7	\$42,561.00	\$9,708.47	\$1,444.85
52	2067	7					7						7						7			
53 54	2068 2069	7					7						7						7			
54	2069	7					7						7						7			
56	2071	7					7						7						7			
57 58	2072 2073	7					7						7						7			
59	2074	7					7						7						7			
60 61	2075	6					6						6						6			
61	2076 2077	6					6						6						6			
63	2078	6					6						6						6			
64 65	2079 2080	6					6						6						6			
33	2000						U						U						Total Cost =	\$1,181,231.99	\$530,958.98	\$210,107.43
																			oroge Dec	6.12		
	Comments:																	Av	erage Rating = End Rating =	6.13		
	-																					

	BUFFALO	RANGE	TI OP WB (#1387) / I-4	0 / MP :	225.05																	
			Minimum Repairs Then R																			
	Bridge De	eck Area =	4301 SF		Notes:	'ear" column means current	hridge is nea	aring the end of its expected sen	vice life					ltem	Slope =	erioration Line Eq	uation Years	Year Drop				
		eck Area =	4729 SF					replacement should be selected						Substr	у =	-0.000423x	-0.154x	6.48				
		ear Built =	1970			does not account for any de								Superstr	y =	-0.000616x	-0.225x	4.45				
	Exp Sen	vice Life =	75 YR			eck area applies to bridge re (after bridge replace) shoul		inly. deck deterioration of 1 point eve	ry 20 years.	. Repair (Deck) sh	ould maintain o	deck rating fo	ır	Deck	y =	-0.000384x	-0.140x	7.14				
					life of repai	ir, if the rating would otherw	ise drop a p	oint (i.e., if the rating would dro	p from a "5"	" to a "4", Repair [												
					6. For other rep	pair items, the "+" value rati	ng should be	e applied to improve the bridge i	rating's valu	e for that year.												
	5	Substructure	2				Superstruct	<u>ture</u>					<u>Deck</u>							Summary		
	Year	Rating	Item	Cost (Per	Cost (Total)	Service Life Rating	Rating	Item	Cost (Per	Cost (Total)	Service Life	Rating	Rating	ltem	Cost (Per	Cost (Total)	Service Life	Rating	Minimum	Total Cost Per Year	Present Value at 3%	Present Value at 7%
		······································		SF)	cost(rotal)	Increase			SF)	Cost (Total)	Jerrice Eric	Increase			SF)	cost (Total)	Service Line	Increase	Rating	(2015 \$ raw costs)	Tresent value de 5/5	Tresent value ut 7/0
0	2015 2016	6					5 5						5 5									
2	2017	6	No Rehab/Repair Wo	ork Can Bo I	Dona Not Vot In I	E. Voor Brogram	5	No Rehab/Repair W	ork Can Bo F	Done Not Vet In	- Voar Brogram		5	No Rehab/Repair W	ork Can Bo F	ione Not Vet In E	- Voor Brogram	,				
3	2018	6	No Kenab/Kepan Wo	ork can be i	bolle. Not fet ill :	5- Teal Plogram.	5	No kenab/kepan w	OIR Call be L	Done. Not fet in :	o- real Program.		5	No neliably nepali Wi	OIR Call Be L	one. Not fet in s	o-real Program					
4 5	2019 2020	6					5 4						5 5									
6	2021	5					5	Repair (Supr - Conc)	\$5.00	\$21,505.00	4	+1	5	Repair (Deck)	\$3.00	\$12,903.00	7	+0	5	\$34,408.00	\$28,816.16	\$22,927.50
7 8	2022 2023	5 5					5 5						5 5						5 5			
9	2024	5					5						5						5			
10 11	2025 2026	5					4	Repair (Supr - Conc)	\$5.00	\$21,505.00	4	+1	5 5						4 5	\$21,505.00	\$15,535.67	\$10,216.87
12	2027	4					5	nepair (Jupi - conc)	Ş3.00	y21,303.00	-	. 1	5						4			
13 14	2028 2029	5	Repair (Substr)	\$5.00	\$21,505.00	6 +1	5						5	Repair (Deck)	\$3.00	\$12,903.00	7	+0	5	\$34,408.00	\$23,430.17	\$14,278.10
15	2030	5					4						5						4			
16	2031	5					5	Repair (Supr - Conc)	\$5.00	\$21,505.00	4	+ 1	5						5	\$21,505.00	\$13,401.21	\$7,284.49
17 18	2032 2033	5					5						5						5			
19	2034	4	0	A= a-	49		5						5	D	40.0-	A40 000	_		4	An	A10.000.00	40.001.0-
20 21	2035 2036	5 5	Repair (Substr)	\$5.00	\$21,505.00	6 +1	4 5	Repair (Supr - Conc)	\$5.00	\$21,505.00	4	+1	5 5	Repair (Deck)	\$3.00	\$12,903.00	7	+0	4 5	\$34,408.00 \$21,505.00	\$19,050.88 \$11,560.00	\$8,891.68 \$5,193.74
22	2037	5					5	,	70.00	, , , , , , , , , , , , , , , , , , , ,			5						5	¥=-/*****	7/	<del>10</del> /-0011
23 24	2038 2039	5 5					5						5						5			
25	2040	5					4						5						4			
26	2041	4	Descripte hard	ć= 00	£24 F0F 00	6 .4	5	Repair (Supr - Conc)	\$5.00	\$21,505.00	4	+ 1	5	0(01)	£2.00	ć42 002 00	_		4	\$21,505.00	\$9,971.76	\$3,703.06
27 28	2042 2043	5 5	Repair (Substr)	\$5.00	\$21,505.00	6 +1	5						5 5	Repair (Deck)	\$3.00	\$12,903.00	7	+0	5	\$34,408.00	\$15,490.11	\$5,537.29
29	2044	5		4.00.0.	4000 000 00		5						5						5	4000 000 00	4000 540 50	4444 000 40
30 31	2045 2046	8	Replace (Bridge)	\$195.31	\$923,620.99	75 Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	\$923,620.99	\$380,519.62	\$121,333.43
32	2047	8					8						8						8			
33 34	2048 2049	8					8						8						8			
35	2050	8					8						8						8			
36 37	2051 2052	8 8					8 8						8						8			
38	2053	8					8						8						8			
39 40	2054 2055	8					8						8						8			
41	2056	7					7						7						7			
42	2057	7					7						7						7			
43 44	2058 2059	7					7						7						7			
45	2060	7					7						7						7			
46 47	2061 2062	7					7						7						7			
48	2063	7					7						7						7			
49 50	2064 2065	6 7	Repair (After Bridge Replace)	\$3.00	\$14,187.00	20 +1	6 7	Repair (After Bridge Replace)	\$3.00	\$14, 187.00	20	+1	6 7	Repair (After Bridge Replace)	\$3.00	\$14,187.00	20	+0	6 7	\$42,561.00	\$9,708.47	\$1,444.85
51	2066	7					7						7						7			. ,
52 53	2067 2068	7 7					7						7						7			
54	2069	7					7						7						7			
55 56	2070 2071	7					7						7						7			
57	2071	7					7						7						7			
58	2073	7					7						7						7			
59 60	2074 2075	6					6						6						7 6			
61	2076	6					6						6						6			
62 63	2077 2078	6					6						6						6			
64	2079	6					6						6						6			
65	2080	6					6						6						6 Total Cost =	\$1,189,833.99	\$527,484.02	\$200,811.01
																					73C1,404.UZ	7200,011.01
	Comments																	Av	erage Rating =	6.13		
	Comments:																		End Rating =	6		

#### **BUFFALO RANGE TI OP WB (#1387) / I-40 / MP 225.05** OST COMPARISON Present Value 2015 Dollars - Raw Costs COST COMPARISON Present Value 2015 Dollars - Fully Loaded Costs Comparison to Replacement AGENCY COST 3% 7% OPTION AGENCY COST 3% 7% OPTION Option Agency Cost 3% 7% Option 1 (Replace) \$ 1,008,742.99 \$804,180.31 \$624,670.38 2 (Rehab) 85.40% 151.46% 297.31% Option 1 (Replace) \$2,219,235 \$1,769,197 \$1,374,275 152.46% 311.07% Option 2 (Rehab) \$ 1,181,231.99 \$530,958.98 \$210,107.43 3 (Repair) 84.78% Option 2 (Rehab) \$2,598,710 \$1,168,110 \$462,236 \$527,484.02 Option 3 (Repair) \$ 1,189,833.99 \$200,811.01 Option 3 (Repair) \$2,617,635 \$1,160,465 \$441,784 Bridge Ratings Per Option AVG RATING **END RATING** OPTION Option 1 (Replace) 6.45 6.13 Option 2 (Rehab) 6.13 6 Option 3 (Repair) **COST COMPARISON RATING COMPARISON** \$1,200,000.00 \$1,000,000.00 Option 1 - Replace Bridge Now \$800,000.00 Option 2 - Perform Bridge Rehabilitiation Then Present Value at 7% Replace \$600,000.00 ■ Present Value at 3% Option 3 - Perform Minimum Repairs Then ■ AGENCY COST \$400,000.00 Replace AGENCY COST \$200,000.00 Present Value at 3% \$0.00 Present Value at 7% Option 1 (Replace) Option 2 (Rehab) Option 3 (Repair)

LEROUX WASH BR EB (#1772) / I-	-40 / MP 284.31								
Bridge Information			<b>Deterioration Slope</b>						
Bridge Deck Area (A225)	19492 SF		Item	Deterioratio	n Line Equation		Year		
Year Built (N27)	1977		iteiii	Slope =	Days	Years	Drop		
Exp Service Life	75 YR		Substr	y =	-0.000435x	-0.159x	6.31		
Total Bridge Length (N49)	439 LF		Superstr	y =	-0.000411x	-0.150x	6.67		
Number of Spans (N45+N46)	6		Deck	y =	-0.000137x	-0.050x	20.00		
Skew Angle (N34)	45 DEG								
Average Elevation	5072 FT								
Max Pier Height	8 FT					Notes:			
* Amount of Widening for Bridge	0 FT		*Input 0 if no widening. Inp	out should include widening on both sides of		1. Widenin	g is intend	ed only to corr	ect lane and/o
Revised Deck Area (Bridge Replace)	19492 FT		bridge if applicable.			shoulder wi	idth deficie	encies. It is not	t intended for
**Scour Critical Rating (N113)	7		**If scour critical rating is 3	or lower, Option 2 should consider the		adding traff	ic capacity	(i.e. adding ge	eneral purpose
			implementation of scour co	ountermeasures.		lanes).			
Cost Multipliers				L to # Span Multiplier	]		Skew Mu	ultiplier	
Elevation > 4000ft	5072	1.25		L/ # Span Ratio	Multiplier		Skew	Multiplier	
Pier Height > 30ft	8	1.00		=>100	1.00		<30	1.00	
Length to # span ratio	73.17	1.1		=>60	1.10		=>30	1.10	
Skew > 30degrees	45.00	1.10		<60	1.25				
roject Cost Multiplier	All Options	2.20							
	·								
Adjusted Bridge Replace Cost			<b>Elevation Multiplier</b>			Pier H Multi	iplier		
Pace Pridge Ponlacement Cost /Per CT\	\$125.00		Elev	Multiplier		Pier H	Multiplie	r	
Base Bridge Replacement Cost (Per SF)	\$125.00		<4000	1.00		<30	1.00		
Bridge Replacement Cost w/ Multipliers	\$189.06		=>4000	1.25		=>30	1.10		
(Per SF)	7107.00								
					User input cell				
					Only manipulate cell va	lue after consulti	ng with te	am	

					Bridge	History	(Inspectio	วทร/As-bเ	uilts)							
					Description								Cate	egory		Year
Original cor	nstruction I-40-4(30).															1977
I-040-D-NF	A provided scour pro	otection.										Reh	ab (Sub	str - Sco	ur)	2007
I-040-D(22	3)T provided a new d	leck overlay.											Replace	e (Deck)		2015
Cracks note years).	ed in superstructure a	and substructu	re is in poor cond	dition. (	Consider reh	ab of bot	th for optio	on 2. Deck	is alread	y done (t	nerefore 20					

Replace / Rehab / Repair Inform	nation			
nepiaee, nenab, nepan injoin				
BRIDGE DECK				
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Deck)	Full Deck Replacement	\$94.53	25	Rating = 8
Rehab (Deck Concrete Overlay)	Overlay (Concrete)	\$10.00	15	+ 2
Rehab (Deck Epoxy Overlay)	Overlay (Epoxy)	\$5.00	10	+1
Repair (Deck)	Patch Spalls / Seal Cracks	\$3.00	See Deterioration Slope	+0
Replace (Bridge)	Full Bridge Replacement	\$189.06	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	\$3.00	20	+0
Repair (After Rehab)	Patch Spalls / Seal Cracks	\$3.00	10	+0
SUPERSTRUCTURE - STEEL				<u> </u>
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Supr - Stl)	Full SuperStr Replacement	\$94.53	50	Rating = 8
Rehab (Supr - Stl)	Weld New Structural Components	\$47.27	15	+ 2
Repair (Supr - Stl)	Weld Repair / Crack Relief	\$5.00	See Deterioration Slope	+1
SUPERSTRUCTURE - CONCRETE				
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Supr - Conc)	Full SuperStr Replacement	\$94.53	50	Rating = 8
Rehab (Supr - Conc)	Replace Structural Component	\$47.27	15	+ 2
Repair (Supr - Conc)	Patch Spalls / Seal Cracks	\$5.00	See Deterioration Slope	+1
Replace (Bridge)	Full Bridge Replacement	\$189.06	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	\$3.00	20	+1
Repair (After Rehab)	Patch Spalls / Seal Cracks	\$3.00	10	+1
SUBSTRUCTURE - STRUCTURAL				
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Substr)	Full SubStr Replacement	\$94.53	75	Rating = 8
Rehab (Substr)	Replace Structural Component	\$47.27	50	+ 2
Repair (Substr)	Patch Spalls / Seal Cracks	\$5.00	See Deterioration Slope	+1
SUBSTRUCTURE - SCOUR				1
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Rehab (Substr - Scour)	Add scour protection slabs	\$47.27	50	+ 2
Repair (Substr - Scour)	Patch Spalls / Seal Cracks	\$5.00	See Deterioration Slope	+1
Replace (Bridge)	Full Bridge Replacement	\$189.06	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	\$3.00	20	+1
Repair (After Rehab)	Patch Spalls / Seal Cracks	\$3.00	10	+ 1

LERO	IIX W	/ΔSH BR	EB (#1772) / I-40 / N	ID 284 31	1		-															
				11 204.31																		
Optio	on 1 - K	керіасе в	ridge Now		Notes:											Dot	erioration Line Equation					
Rri	idge Der	ck Area =	19492 SF			ear" column m	neans current h	ridge is r	nearing the end of its expected servi	rice life.					Item	Slope =	Days Years	Year Drop				
		ck Area =	19492 SF						ck replacement should be selected						Substr	у =		6.31				
		ar Built =	1977						ng during replacement.						Superstr	y =		6.67				
Е	xp Servi	ice Life =	75 YR		4. Widened de	ck area applie	s to bridge rep	lacemen	t only.						Deck	y =	-0.000137x -0.050x	20.00				
					5. Repair deck	(after bridge r	replace) should	d provide	a deck deterioration of 1 point ever	ry 20 years.												
	c,	ubstructure						Superstr	uctura					Deck						Summary		
	31	ubstructure						Supersu	<u>rtture</u>		İ			DECK								
Yea	ar	Rating	Item	Cost (Per	Cost (Total)	Service Life	Rating	Rating	Item	Cost (Per	Cost (Total)	Service Life	Rating	Rating	Item	Cost (Per	Cost (Total) Service Life	Rating	Minimum	Total Cost Per Year	Present Value at 3%	Present Value at 7%
				SF)			Increase			SF)			Increase	_		SF)		Increase	Rating	(2015 \$ raw costs)		
201		4						5						7								
201		4						5						7								
201 201		4	No Rehab/Repair W	ork Can Be D	Oone. Not Yet In 5	-Year Program	n.	5 5	No Rehab/Repair Wo	ork Can Be D	Oone. Not Yet In !	5-Year Program.		7	No Rehab/Repair Wo	ork Can Be D	Done. Not Yet In 5-Year Program	m.				
201		4						5						7								
202		4						5						7								
202		8	Replace (Bridge)	\$189.06	\$3,685,157.52	75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	Replace (Bridge)		75	Rating = 8	8	\$3,685,157.52	\$3,086,261.41	\$2,455,576.06
202		8						8						8					8			
202		8						8						8					8			
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202		8						8						8					8			
202 202		8						٥ 2						8					8			
202		8						8						8					8			
202		8						8						8					8			
203	30	8						8						8					8			
203	31	7						7						7					7			
203		7						7						7					7			
203		7						7						7					7			
203		7 7						7						7					7			
203		7						7						7					7			
203		7						7						7					7			
203		7						7						7					7			
203	39	7						7						7					7			
204		6						6						6					6			
204		7 F	Repair (After Bridge Replace)	\$3.00	\$58,476.00	20	+1	7	Repair (After Bridge Replace)	\$3.00	\$58,476.00	20	+1	7	Repair (After Bridge Replace)	\$3.00	\$58,476.00 20	+0	7	\$175,428.00	\$81,345.04	\$30,207.91
204 204		7						7 7						7					7			
204		7						7						7					7			
204		7						7						7					7			
204		7						7						7					7			
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204		7						7						7					7			
204 205		7						7						7					7			
205		6						6						6					6			
205		6						6						6					6			
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205		6						6						6					6			
205		6						6						6					6			
205 205		6						6						6					6			
205		6						6						6					6			
206		5						5						5					5			
206		6 F	Repair (After Bridge Replace)	\$3.00	\$58,476.00	20	+1	6	Repair (After Bridge Replace)	\$3.00	\$58,476.00	20	+1	6	Repair (After Bridge Replace)	\$3.00	\$58,476.00 20	+0	6	\$175,428.00	\$45,038.78	\$7,806.30
206		6						6						6					6			
206		6						6						6					6			
206 206		6						6 6						6					6			
206		6						6						6					6			
206		6						6						6					6			
206		6						6						6					6			
206		6						6						6					6			
207		5						5						5					5			
207		5						5						5 5					5			
207 207		5						5 5						5					5			
207		5						5						5					5			
207		5						5						5					5			
207		5						5						5					5			
207		5						5						5					5			
207		5						5						5					5			
207		5						5 5						5 5					5			
208	OU .	5						5						5					Total Cost =	\$4,036,013.52	\$3,212,645.22	\$2,493,590.27
																				y .,000,013:32	VO)	Q2, 100,000.27
																		A	erage Rating =			
Comme	ents:																		End Rating =	5		
-	-																					
	-																					

State   Stat		7 6110111	n Bridge Rehabilitiation Th		Notes:											Det	erioration Line Equ	uation	V 5				
March   Marc																_							
Part										as well.													
Part																				-			
The content of the	EXD 26	ervice Lite =	- /5 YK	1						ry 20veam	Renair (Deck) ch	nould maintain d	ock rating for	-	Deck	y =	-U.UUU13/X	-U.U5UX	20.00	-			
Second Content														t vear.)									
Part														1 1									
Martin   M																							
The column   Column		Substructu	<u>ure</u>					Superstr	<u>ucture</u>				Deck	<u>ck</u>							Summary		
Market   M	Year	Rating	ltem		Cost (Total)	Service Life		Rating	Item		Cost (Total)	Service Life		Rating	ltem		Cost (Total)	Service Life	_			Present Value at 3%	Present Va
Column   C	2015																						
	2016																						
Second   S	2018	4	No Rehab/Repair W	ork Can Be D	Done. Not Yet In S	5-Year Progran	m.		No Rehab/Repair W	ork Can Be D	one. Not Yet In S	5-Year Program.			No Rehab/Repair Wo	ork Can Be E	Done. Not Yet In 5-	-Year Program	n.				
Second Column   Second Colum	2019							5															
Column   C			Debelo (C. bara)	647.07	¢024 200 20			5	Debek (Corrections)	647.27	¢024 200 20	45									Ć4 042 570 76	64 542 420 70	ć4 227 T
Control   Cont		6	Rehab (Substr)	\$47.27	\$921,289.38	50	+ 2		Rehab (Supr - Conc)	\$47.27	\$921,289.38	15									\$1,842,578.76	\$1,543,130.70	\$1,227,7
		6						7						7									
Marchand   Marchand	2024	6						7						7									
State   Stat	2025	6						7						7									
222   24	2026	6						7						6									
	2027	6						7						6									
		6						6						6									
No.   No.	2029	6						6						6									
Series   Ser	2031	6						6						6									
Second   S	2032	6						6						6									
Second   S	2033	6						6						6									
200   1	2034	6						6						6									
200   1		6						6						6									
200 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		6						6	Repair (After Rehab)	\$3.00	\$58,476,00	10	+1	5						_	\$58,476,00	\$30.518.19	\$13,19
Control   Cont	2038	6						6	nepan (meer nemab)	φ5.00	Ç30, 17 0.00	10		5							\$50, 17 0.00	<b>\$30,310.13</b>	Ų13,13
State	2039	6						6						5						5			
Second   S	2040	6						6							Repair (Deck)	\$3.00	\$58,476.00	20	+0		\$58,476.00	\$27,928.46	\$10,77
900   6   9   9   9   9   9   9   9   9   9	2041	6						6															
Second   S		6						5						5									
Second   S	2043	6						5						5									
Second   S	2045	6						5						5									
See See See See See See See See See See	2046	5						5						5									
Second Second	2047	5						4		4	4=0 :-			5						-		4	
5   September (Bridger)   5   September (Bri	2048	5						5	Repair (After Rehab)	\$3.00	\$58,476.00	10	+1	5							\$58,476.00	\$22,046.99	\$6,270
State   Stat		5						5						5									
Martin	2051	5						5															
1953   8	2052	8	Replace (Bridge)	\$189.06	\$3,685,157.52	75	Rating = 8	8	Replace (Bridge)			75		-	Replace (Bridge)			75	Rating = 8		\$3,685,157.52	\$1,234,464.89	\$301,47
1005   8   8   9   9   9   8   8   9   9   9	2053	8	-					8						8									
036	2054	8						8						8									
100   100	2055	8						8						8									
0.00		8						8						8						-			
88	2057	8						8						8						8			
1000   8	2059	8						8						8						8			
1992 7 1993 7 1994 7 1995 7 19	2060	8						8						8									
068	2061	8						8						8									
1004		7						7						7									
1005		7						7						7						_			
066 7 067 7 088 7 089 7 070 7		7						7						7						_			
067		7												7						_			
1	067	7						7						7						_			
100		7						7						7						_			
1071     6     7     Repair (After Bridge Replace)   53.00   558,476.00   20   +1   7     Repair (After Bridge Replace)   53.00   558,476.00   20   +1   7     Repair (After Bridge Replace)   53.00   558,476.00   20   +0   7     5175,428.00   532,536.97     1072   7     7		7						7						7						_			
7 Repair (After Bridge Replace) \$3.00 \$58,476.00 20 +1 7 Repair (After Bridge Replace) \$3.00 \$58,476.00 20 +0 7 \$175,428.00 \$32,536.97 \$170,428.00 \$170,428.00		6						6						6									
2073 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	2072	7	Repair (After Bridge Replace)	\$3.00	\$58,476.00	20	+1	7	Repair (After Bridge Replace)	\$3.00	\$58,476.00	20	+1	7 1	Repair (After Bridge Replace)	\$3.00	\$58,476.00	20	+0		\$175,428.00	\$32,536.97	\$3,708
2075 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	2073	7	, , , , ,					7	, , , , , , , , , , , , , , , , , , , ,						, , , , ,						·		
1076   7   7   7   7   7   7   7   7   7	2074	7						-						7									
7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	2075	7						-						7									
7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7		7						-												-			
7 7 7 7 7 7 8 8 9 9 9 9 9 9 9 9 9 9 9 9	2077	7						-												_			
7 7 7 Total Cost = \$5,878,592.28 \$2,890,626.20 SAPERING = 6.35	2079	7						-												_			
Average Rating = 6.35	2080	7						7						7									
																				Total Cost =	\$5,878,592.28	\$2,890,626.20	\$1,563,2
																			Α.	verage Rating -	6.35		
	ments:																		A				
																	İ						

Bridge De	ck Area =	19492 SF		Notes: 1. Red fill in "Ye	ear" column	neans current	bridge is n	nearing the end of its expected ser	vice life					ltem	Slope =	erioration Line Equa Days	ation Years	Year Drop				
Widen De		19492 SF						ck replacement should be selected						Substr	y =	-0.000435x	-0.159x	6.31				
Ye	ear Built =	1977		3. Deck Rehab	does not accor	unt for any de	ck widenin	ng during replacement.						Superstr	y =	-0.000411x	-0.150x	6.67				
Exp Serv	vice Life =	75 YR		4. Widened de									ļ	Deck	y =	-0.000137x	-0.050x	20.00				
								a deck deterioration of 1 point even point (i.e., if the rating would dro														
								be applied to improve the bridge			would fild!	J at tild	.scycui.									
				. •						,												
<u>s</u>	<u>ubstructure</u>						Superstru	<u>ucture</u>				<u>De</u>	<u>eck</u>							<u>Summary</u>		
	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	ltem	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Minimum Rating	Total Cost Per Year (2015 \$ raw costs)	Present Value at 3%	Present Val
2015 2016 2017 2018 2019	4 4 4 4	No Rehab/Repair W	ork Can Be D	one. Not Yet In 5	5-Year Progran	n.	5 5 5 5	No Rehab/Repair W	ork Can Be D	one. Not Yet In 5	5-Year Program.		7 7 7 7	No Rehab/Repair W	/ork Can Be [	Oone. Not Yet In 5-Y	Year Program	ı.				
2020 2021	5	Repair (Substr)	\$5.00	\$97,460.00	6	+1	5	Repair (Supr - Conc)	\$5.00	\$97,460.00	7	+1	7						5	\$194,920.00	\$163,242.43	\$129,88
2021	5	Repair (Substr)	\$5.00	\$97,400.00	0	7.1	6	Repair (Supi - Coric)	\$5.00	397,400.00	,	*1	7						5	\$194,920.00	\$105,242.45	\$129,00
2023	5						6						7						5			
2024	5						6						7						5			
2025	5 5						6						7						5 5			
2026 2027	5						5						6						5			
2027	4						6	Repair (Supr - Conc)	\$5.00	\$97,460.00	7	+1	6						4	\$97,460.00	\$66,365.52	\$40,442
2029	5	Repair (Substr)	\$5.00	\$97,460.00	6	+1	6						6						5	\$97,460.00	\$64,432.54	\$37,79
2030	5						6						6						5			
2031 2032	5 5						6						6						5 5			
2032	5						5						6						5			
2034	5						6	Repair (Supr - Conc)	\$5.00	\$97,460.00	7	+1	6						5	\$97,460.00	\$55,580.08	\$26,94
2035	5						6						6						5			
2036	4		4	Agr. : -:			6						5						4	4	4	
2037	5	Repair (Substr)	\$5.00	\$97,460.00	6	+1	6						5 5						5	\$97,460.00	\$50,863.64	\$21,998
2038 2039	5 5						6						5 5						5			
2039	5						6	Repair (Supr - Conc)	\$5.00	\$97,460.00	7	+1	5	Repair (Deck)	\$3.00	\$58,476.00	20	+0	5	\$155,936.00	\$74,475.90	\$28,73
2041	5						6		72.00	<b>+</b> 2., 100100			5		75.00	,			5	+,550.00	Ţ, 5.50	Ç20,73
2042	5						6						5						5			
2043	5						6						5						5			
2044 2045	4 5	Repair (Substr)	\$5.00	\$97,460.00	6	+1	6						5						4 5	\$97,460.00	\$40,152.23	\$12,80
2045	5	Repail (Substr)	<b>33.00</b>	291,40U.UU	б	+1	6	Repair (Supr - Conc)	\$5.00	\$97,460.00	7	+1	5						5	\$97,460.00	\$40,152.23	\$12,80
2047	5						6		72.00	<b>+=., 100100</b>	Ĺ	-	5						5	<b>42.7100.00</b>	,30E.73	Ç11,50
2048	5						6						5						5			
2049	5						6						5						5			
2050	5 5						6						5 5						5 5			
2051 2052	8	Replace (Bridge)	\$189.06	\$3,685,157.52	75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	\$3,685,157.52	\$1,234,464.89	\$301,47
2052	8	ep.ace (briage)	Ç203.00	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	,,,	ing = 0	8	neplace (blidge)			,3		8	neplace (bridge)			,,		8	93,003,137.32	V-1/2-7/7-07-03	,301,47
2054	8						8						8						8			
2055	8						8						8						8			
2056	8						8						8						8			
2057 2058	8						8						8						8			
2059	8						8						8						8			
2060	8						8						8						8			
2061	8						8						8						8			
2062	7						7						7						7			
2063 2064	7						7						7 7						7			
2064	7						7						7						7			
2066	7						7						7						7			
2067	7						7						7						7			
2068	7						7						7						7			
2069 2070	7						7						7						7			
2070	6						6						6						6		1	
2072	7 Rep	pair (After Bridge Replace)	\$3.00	\$58,476.00	20	+1	7	Repair (After Bridge Replace)	\$3.00	\$58,476.00	20	+1	7	Repair (After Bridge Replace)	\$3.00	\$58,476.00	20	+0	7	\$175,428.00	\$32,536.97	\$3,708
2073	7						7						7						7			
2074 2075	7						7						7 7						7			
2076	7						7						7						7			
2077	7						7						7						7			
2078	7						7						7						7			
2079	7 7						7						7 7						7 7 Total Cost =	\$4,796,201.52	\$1,821,096.95	\$615,7
																					<b>42,022,030.33</b>	<b>7013,73</b>
						-												Av	erage Rating =	6.07	1	
nments:																			End Rating =	7	J	

# LEROUX WASH BR EB (#1772) / I-40 / MP 284.31 COST COMPARISON Present Value 2015 Dollars - Fully Loaded Costs OST COMPARISON Present Value 2015 Dollars - Raw Costs Comparison to Replacement AGENCY COST 3% 7% OPTION AGENCY COST 3% 7% Option **Agency Cost** 3% 7% Option 1 (Replace) \$ 4,036,013.52 \$3,212,645.22 \$2,493,590.27 2 (Rehab) 68.66% 111.14% 159.52% Option 1 (Replace) \$8,879,230 \$7,067,819 \$5,485,899 Option 2 (Rehab) \$ 5,878,592.28 \$2,890,626.20 \$1,563,218.81 176.41% 404.96% 3 (Repair) 84.15% Option 2 (Rehab) \$12,932,903 \$6,359,378 \$3,439,081 Option 3 (Repair) | \$ 4,796,201.52 | \$1,821,096.95 Option 3 (Repair) \$10,551,643 \$4,006,413 \$1,354,663 Bridge Ratings Per Option **AVG RATING END RATING** OPTION Option 1 (Replace) 6.45 6.35 7 Option 2 (Rehab) 7 Option 3 (Repair) 6.07 **COST COMPARISON RATING COMPARISON** \$6,000,000.00 \$5,000,000.00 Option 1 - Replace Bridge Now \$4,000,000.00 Option 2 - Perform Bridge Rehabilitiation Then ■ Present Value at 7% Replace \$3,000,000.00 ■ Present Value at 3% Option 3 - Perform Minimum Repairs Then ■ AGENCY COST \$2,000,000.00 **AGENCY COST** \$1,000,000.00 Present Value at 3% \$0.00 Present Value at 7% Option 1 (Replace) Option 2 (Rehab) Option 3 (Repair)

LEROUX WASH BR WB (#1773) /	I-40 / MP 284.3	1							
	•								
Bridge Information			<b>Deterioration Slope</b>		-	·	·		
Bridge Deck Area (A225)	19492 SF		ltem	Deterioratio	n Line Equation		Year		
Year Built (N27)	1977		item	Slope =	Days	Years	Drop		
Exp Service Life	75 YR		Substr	y =	-0.000411x	-0.150x	6.67		
Total Bridge Length (N49)	439 LF		Superstr	y =	-0.000411x	-0.150x	6.67		
Number of Spans (N45+N46)	6		Deck	y =	-0.000137x	-0.050x	20.00		
Skew Angle (N34)	45 DEG								
Average Elevation	5072 FT								
Max Pier Height	8 FT					Notes:			
* Amount of Widening for Bridge	0 FT		*Input 0 if no widening. Inp	ut should include widening on both sides of		1. Widenin	g is intend	ed only to corr	rect lane and/o
Revised Deck Area (Bridge Replace)	19492 FT		bridge if applicable.			shoulder wi	idth defici	encies. It is no	t intended for
**Scour Critical Rating (N113)	7		**If scour critical rating is 3	or lower, Option 2 should consider the		adding traff	ic capacity	(i.e. adding ge	eneral purpose
			implementation of scour co	untermeasures.		lanes).			
Cost Multipliers				L to # Span Multiplier			Skew Mu	ultiplier	
Elevation > 4000ft	5072	1.25		L/ # Span Ratio	Multiplier		Skew	Multiplier	
Pier Height > 30ft	8	1.00		=>100	1.00		<30	1.00	
Length to # span ratio	73.17	1.1		=>60	1.10		=>30	1.10	
Skew > 30degrees	45.00	1.10		<60	1.25				
Project Cost Multiplier	All Options	2.20							
	·								
Adjusted Bridge Replace Cost			Elevation Multiplier			Pier H Multi	iplier		
	Ć425.00		Elev	Multiplier		Pier H	Multiplie	er	
Base Bridge Replacement Cost (Per SF)	\$125.00		<4000	1.00		<30	1.00		
Bridge Replacement Cost w/ Multipliers	¢400.00		=>4000	1.25		=>30	1.10		
(Per SF)	\$189.06								
					User input cell				
					Only manipulate cell va	lue after consulti	ng with te	am	

					Bridge Hi	story (Insp	pections/As	s-builts)								
				Descr	ription								Cate	egory		Year
Original cor	nstruction I-40-4(30).															1977
I-040-D-NF	A provided scour pro	otection.										Reh	nab (Sub	str - Sco	ur)	2007
I-040-D(22	3)T provided a new d	leck overlay.											Replace	e (Deck)		2015
Cracks note years).	ed in superstructure a	and substructur	e is in poor condit	tion. Con	sider rehab	of both for	option 2. D	eck is alrea	ady done	(therefore 20	)					

Replace / Rehab / Repair Inform	nation			
nepiaee, nenab, nepan injoin				
BRIDGE DECK				
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Deck)	Full Deck Replacement	\$94.53	25	Rating = 8
Rehab (Deck Concrete Overlay)	Overlay (Concrete)	\$10.00	15	+ 2
Rehab (Deck Epoxy Overlay)	Overlay (Epoxy)	\$5.00	10	+1
Repair (Deck)	Patch Spalls / Seal Cracks	\$3.00	See Deterioration Slope	+0
Replace (Bridge)	Full Bridge Replacement	\$189.06	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	\$3.00	20	+0
Repair (After Rehab)	Patch Spalls / Seal Cracks	\$3.00	10	+0
SUPERSTRUCTURE - STEEL				<u> </u>
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Supr - Stl)	Full SuperStr Replacement	\$94.53	50	Rating = 8
Rehab (Supr - Stl)	Weld New Structural Components	\$47.27	15	+ 2
Repair (Supr - Stl)	Weld Repair / Crack Relief	\$5.00	See Deterioration Slope	+1
SUPERSTRUCTURE - CONCRETE				
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Supr - Conc)	Full SuperStr Replacement	\$94.53	50	Rating = 8
Rehab (Supr - Conc)	Replace Structural Component	\$47.27	15	+ 2
Repair (Supr - Conc)	Patch Spalls / Seal Cracks	\$5.00	See Deterioration Slope	+1
Replace (Bridge)	Full Bridge Replacement	\$189.06	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	\$3.00	20	+1
Repair (After Rehab)	Patch Spalls / Seal Cracks	\$3.00	10	+1
SUBSTRUCTURE - STRUCTURAL				
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Substr)	Full SubStr Replacement	\$94.53	75	Rating = 8
Rehab (Substr)	Replace Structural Component	\$47.27	50	+ 2
Repair (Substr)	Patch Spalls / Seal Cracks	\$5.00	See Deterioration Slope	+1
SUBSTRUCTURE - SCOUR				1
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Rehab (Substr - Scour)	Add scour protection slabs	\$47.27	50	+ 2
Repair (Substr - Scour)	Patch Spalls / Seal Cracks	\$5.00	See Deterioration Slope	+1
Replace (Bridge)	Full Bridge Replacement	\$189.06	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	\$3.00	20	+1
Repair (After Rehab)	Patch Spalls / Seal Cracks	\$3.00	10	+ 1

II FROLIX	W/ASH R	R WB (#1773) / I-40 / I	MP 284 3	31																	
			207.3															1			
Option 1	- керіасе	Bridge Now		Notes:											Det	and and the Counties					
Bridge !	Deck Area =	19492 SF			ear" column m	neans current h	ridge is n	earing the end of its expected servic	e life					ltem	Slope =	erioration Line Equation  Days Years	Year Drop				
	Deck Area =	19492 SF						ck replacement should be selected as						Substr	310pe = y =		6.67				
	Year Built =	1977						ng during replacement.						Superstr	y = y =		6.67				
	ervice Life =	75 YR		4. Widened de										Deck	y =		20.00				
								a deck deterioration of 1 point every	20 years.												
							_												-		
	Substructu	r <u>e</u>					Superstru	icture					Deck						Summary		
Year	Rating	Item	Cost (Per	Cost (Total)	Sancica Life	Rating	Rating	Item	Cost (Per	Cost (Total)	Samica Life	Rating	Rating	Item	Cost (Per	Cost (Total) Service Life	Rating	Minimum	Total Cost Per Year	Present Value at 3%	Present Value at 79
i cai	Rating	item	SF)	Cost (Total)	Jeivice Life	Increase	Nating	item	SF)	Cost (Total)	Service Life	Increase	itating	iteiii	SF)	cost (rotal) Service Life	Increase	Rating	(2015 \$ raw costs)	Fleselit value at 3/6	rieselli value at 77
2015	4						5						6			·					
2016	4						5						6								
2017	4	No Rehab/Repair W	ork Can Be D	Done. Not Yet In 5	5-Year Program	n.	5	No Rehab/Repair Wor	k Can Be D	one. Not Yet In 5	S-Year Program.		6	No Rehab/Repair We	ork Can Be I	Done. Not Yet In 5-Year Prograr	n.				
2018 2019	4 4				· ·		5 5				•		6			, and the second					
2019	4						5						6								
2021	8	Replace (Bridge)	\$189.06	\$3,685,157.52	75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	Replace (Bridge)		75	Rating = 8	8	\$3,685,157.52	\$3,086,261.41	\$2,455,576.06
2022	8		7-00.00	70,000,000			8						8	(=8-)				8	+0,000, <u>-</u> 0.10_	70,000,000	42,100,01010
2023	8						8						8					8			
2024	8						8						8					8			
2025	8						8						8					8			
2026	8						8						8					8			
2027	8					-	8						8					8			
2028 2029	8						8						8					8			
2029	8						8						8					8			
2031	7						7						7					7			
2032	7						7						7					7			
2033	7						7						7					7			
2034	7						7						7					7			
2035	7						7						7					7			
2036	7						7						7					7			
2037	7					-	7						7					7			
2038 2039	7						7						7					7			
2039	6						6						6					6			
2041	7	Repair (After Bridge Replace)	\$3.00	\$58,476.00	20	+1	7	Repair (After Bridge Replace)	\$3.00	\$58,476.00	20	+ 1	7	Repair (After Bridge Replace)	\$3.00	\$58,476.00 20	+0	7	\$175,428.00	\$81,345.04	\$30,207.91
2042	7	, , , , ,					7						7	. , , , ,				7			
2043	7						7						7					7			
2044	7						7						7					7			
2045	7						7						7					7			
2046 2047	7						7						7					7			
2047	7						7						7					7			
2048	7						7						7					7			
2050	7						7						7					7			
2051	6						6						6					6			
2052	6						6						6					6			
2053	6						6						6					6			
2054	6						6						6					6			
2055	6						6						6					6			
2056 2057	6						6						6					6			
2058	6						6						6					6			
2059	6						6						6					6			
2060	5						5						5					5			
2061	6	Repair (After Bridge Replace)	\$3.00	\$58,476.00	20	+ 1	6	Repair (After Bridge Replace)	\$3.00	\$58,476.00	20	+1	6	Repair (After Bridge Replace)	\$3.00	\$58,476.00 20	+0	6	\$175,428.00	\$45,038.78	\$7,806.30
2062	6						6						6					6			
2063 2064	6						6 6						6					6			
2064	6						6						6					6			
2066	6						6						6					6			
2067	6						6						6					6			
2068	6						6						6					6			
2069	6						6						6					6			
2070	5						5						5					5			
2071 2072	5						5 5						5 5					5			
2072	5						5						5					5			
2074	5						5						5					5			
2075	5						5						5					5			
2076	5						5						5					5			
2077	5						5						5					5			
2078	5						5						5					5			
2079	5					-	5						5 5					5			
2080	5						5						5			+ + + + + + + + + + + + + + + + + + + +		5 Total Cost =	\$4,036,013.52	\$3,212,645.22	\$2,493,590.2
																		rotal COST =	→+,U30,U13.3Z	43,C12,043.ZZ	32,433,39U.Z
																	Av	erage Rating =	6.45		
Comments:																		End Rating =			
																1					

No.   State	LEROUX V	NASH B	R WB (#1773) / I-40 / N	MP 284.	31																		
Subject of the control of the cont	Option 2 - I	Perform	Bridge Rehabilitiation Th	nen Repla																			
Column   C	Drides De	- al- A a	10402 CF			مسامم المما		halalan in a							ltem				Year Drop				
March   Marc															Substr	<del> </del>							
Second Second																							
Part	Exp Sen	vice Life =	75 YR		4. Widened de	eck area app	plies to bridge re	placement	only.						Deck	y =	-0.000137x	-0.050x	20.00				
Part																							
												реск would mai	ricain a "5" at	tnat year.)									
No.   No.					o. Tor other re	pun nenna, l	value i dli	<sub>6</sub> should	ac applied to improve the bridge	. Jung 3 Value	c ror criacyear.												
Mark   Mark	S	Substructu	<u>ire</u>				'	Superstru	cture					Deck							Summary		
Mark   Mark				Cost (Per			Rating			Cost (Per			Rating			Cost (Per			Rating	Minimum	Total Cost Per Year		
	Year	Rating	Item		Cost (Total)	Service Li	ite -	Rating	Item		Cost (Total)	Service Life		Rating	Item		Cost (Total)	Service Life	_			Present Value at 3%	Present Value
	2015	4						5						6									
	2016	4						5															
No.     No.   No		4	No Rehab/Repair W	ork Can Be	Done. Not Yet In	5-Year Progr	ram.		No Rehab/Repair W	ork Can Be D	Done. Not Yet In !	5-Year Program.			No Rehab/Repair W	Vork Can Be D	Oone. Not Yet In 5	S-Year Program	١.				
		4																					
Second   S																							
202   6   10   10   10   10   10   10   10		6	Rehab (Substr)	\$47.27	\$921,289.38	50	+ 2	7	Rehab (Supr - Conc)	\$47.27	\$921,289.38	15	+ 2	6						6	\$1,842,578.76	\$1,543,130.70	\$1,227,788.
30		6						7						6						6			
Section   Sect		6						7						6						6			
500   5		6						7						6						6			
Column	2026	6						7						5						5			
Second   S		6						7						5						5			
1		6						7						5						5			
March   Marc		6						6						5						5			
March   Marc		6						6						5						5		1	
The content of the	2032	6						6						5						5			
No.   No.		6						6						5									
No.     No.   No		6						6						5						5			
250		6						5						5	Renair (Deck)	\$3.00	\$58 476 00	20	+0	5	\$58,476,00	\$31 433 73	\$14,122
1979   1979		6						6	Repair (After Rehab)	\$3.00	\$58,476.00	10	+ 1	5	nepaii (Deak)	Ş3.00	\$30,470.00	20		,			\$13,198
250   250		6						6	, , , , , ,					5						5			
194		6						6						5						,			
202   6		6						6						5						,			
201 6		6						5						5						-			
State   Stat		6						5						5									
206	2044	6						5						_									
267   5   5   6   6   7   7   6   7   7   7   7   7		6						5						-	De1- (D1)	62.00	¢50 470 00	20			¢50 470 00	ć22 200 CT	A
204		5						4						-	kepair (Deck)	\$3.00	ააგ,4/6.00	20	+0		\$58,476.00	\$23,389.65	\$7,179.
250 5 5 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7		_						5	Repair (After Rehab)	\$3.00	\$58,476.00	10	+1	-							\$58,476.00	\$22,046.99	\$6,270.
S	2049	5						5						-									
Part		5						5						5									
252 8		5	Replace (Pridge)	\$190 ne	\$3 685 157 52	75	Rating = 0	5	Replace (Bridge)			75	Rating = 0	5	Replace (Pridge)			75	Rating = 0		\$3 685 157 52	\$1 23/1 /6/1 90	\$301,478
255 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8		8	neplace (bridge)	÷103.00	,5,005,137.32	/3	natilig – 8	8	neplace (biluge)			13	nutilig = 0	8	ne place (blidge)			/3	nating - 8	8	,J,U0J,1J7.J2	Y±,434,404.03	3)4/4/8
256	2054	8						8						8						8			
257 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8		8						8						8						8			
2056 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8		8						8						8						8			
2596   2596		8						8						8						8			
2061   8   8   8   8   8   8   8   8   8		8						8						8						8			
2062 7 7 2064 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7		8						8						8						8			
2054 7		8						8						8						8			
2064   7   7   7   7   7   7   7   7   7		7						7						7									
2066		7						7						7									
2008   7	2065	7						7						7									
2088		7						7						7									
2069 7 2070 7 7 Repair (After Bridge Replace) \$3.00 \$58,476.00 \$20 \$1 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7		7						7						7									
2072 7 Repair (After Bridge Replace) 53.00 S58,476.00 20 +1 7 Repair (After Bridge Replace) 53.00 S58,476.00 20 +1 7 Repair (After Bridge Replace) 53.00 S58,476.00 20 +1 7 Repair (After Bridge Replace) 53.00 S58,476.00 20 +0 7 S175,428.00 S32,536.97 S3,7 2073 7 2076 2076		7						7						7									
2072 7 Repair (After Bridge Replace) \$3.00 \$58,476.00 \$0 \$1 7 Repair (After Bridge Replace) \$3.00 \$58,476.00 \$0 \$1 7 \$ \$175,428.00 \$32,536.97 \$3.7 \$  2073 7	2070	7						7						7									
2073		6						6						6			4						
2074 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7		7	Repair (After Bridge Replace)	\$3.00	\$58,476.00	20	+1	7	Repair (After Bridge Replace)	\$3.00	\$58,476.00	20	+1	_	Repair (After Bridge Replace)	\$3.00	\$58,476.00	20	+0		\$175,428.00	\$32,536.97	\$3,708.
2075		7						7						-									
2076 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7		7						-						-						7			
2078 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	2076	7						7						_									
2079 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7		7						7						-									
2080         7         7         7         Total Cost = \$5,937,068.28         \$2,917,521.11         \$1,573           Company of the control of		7						7															
Total Cost = \$5,937,068.28 \$2,917,521.11 \$1,573		7						7						_									
																_				Total Cost =	\$5,937,068.28	\$2,917,521.11	\$1,573,74
																				P://	6.40		
	Comments:							-										1	Av			1	
	спс																			LING NOUTING =	<u>'</u>		

I	LEROUX \	VASH B	R WB (#1773) / I-40 / N	MP 284.3	31																		
_			Minimum Repairs Then R																				
	D. H. D.		40402.55		Notes:	· · · · · · · · · · · · · · · · · · ·		h dalaa da aa						_	Item		erioration Line Ed	<del>`</del>	Year Drop				
		eck Area = eck Area =	19492 SF 19492 SF						earing the end of its expected se k replacement should be selecte						Substr	Slope =	-0.000411x	-0.150x	6.67				
		ear Built =	1977						g during replacement.	d do wen.					Superstr	y =	-0.000411x	-0.150x	6.67				
		vice Life =	75 YR		4. Widened de										Deck	y =		-0.050x	20.00				
									a deck deterioration of 1 point ex point (i.e., if the rating would dr														
									point (i.e., if the rating would di be applied to improve the bridge			Deck Would Illai	illailla 3 ai	t tilat year.									
		Substructur	<u>re</u>					Superstruc	<u>cture</u>	1				<u>Deck</u>							<u>Summary</u>		
	Year	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Minimum Rating	Total Cost Per Year (2015 \$ raw costs)	Present Value at 3%	Present Value at 79
) L	2015 2016	4						5						6									
2	2017	4	No Rehab/Repair Wo	ork Can Be I	Done. Not Yet In	5-Year Program	n.	5	No Rehab/Repair V	Vork Can Be I	Done. Not Yet In	5-Year Program.		6	No Rehab/Repair W	Vork Can Be D	Oone. Not Yet In !	5-Year Progran	n.				
3 4	2018 2019	4	,,,			- · · · · · · · · · · · · · · · · ·		5	, , , , , , , , , , , , , , , , , , , ,					6									
5	2019	4						5						6									
;	2021	5	Repair (Substr)	\$5.00	\$97,460.00	7	+1	6	Repair (Supr - Conc)	\$5.00	\$97,460.00	7	+1	6						5	\$194,920.00	\$163,242.43	\$129,883.43
3	2022 2023	5						6						6						5 5			
,	2024	5						6						6						5			
0	2025	5						6						6						5			
1 2	2026 2027	5 4						6						5						5 4			
3	2028	5	Repair (Substr)	\$5.00	\$97,460.00	7	+1	6						5						5	\$97,460.00	\$66,365.52	\$40,442.44
1	2029	5						5						5						5 5			
5	2030 2031	5						5						5						5			
7	2032	5						5						5						5			
3	2033 2034	5						5						5 5						5 4			
0	2035	5	Repair (Substr)	\$5.00	\$97,460.00	7	+1	5						5						5	\$97,460.00	\$53,961.24	\$25,185.52
1	2036	5						4						5	Repair (Deck)	\$3.00	\$58,476.00	20	+0	4	\$58,476.00	\$31,433.73	\$14,122.72
3	2037 2038	5 5						5	Replace (Supr - Conc)	\$94.53	\$1,842,578.76	50	Rating = 8	5 5						5	\$1,842,578.76	\$961,628.04	\$415,894.28
4	2039	5						5						5						5			
5	2040	5						5						5						5			
6 7	2041 2042	4 5	Repair (Substr)	\$5.00	\$97,460.00	7	+1	5						5						4 5	\$97,460.00	\$43,875.43	\$15,684.27
18	2042	5	Repail (Substi)	\$5.00	\$37,400.00		7.1	4						5						4	337,400.00	Ş43,673.43	\$13,004.27
9	2044	5						5	Repair (Supr - Conc)	\$5.00	\$97,460.00	7	+1	5						5	\$97,460.00	\$41,356.80	\$13,699.25
0	2045 2046	5						5						5 5	Repair (Deck)	\$3.00	\$58,476.00	20	+0	5 5	\$58,476.00	\$23,389.65	\$7,179.27
2	2047	5						5						5	перин (Беск)	Ş3.00	\$30,470.00	20		5	\$50,470.00	\$25,565.05	\$1,175.27
3	2048	5						5						5						5			
4 5	2049 2050	4 5	Repair (Substr)	\$5.00	\$97,460.00	7	+1	5 4						5						4	\$97,460.00	\$34,635.67	\$9,128.39
6	2051	5						5	Repair (Supr - Conc)	\$5.00	\$97,460.00	7	+1	5						5	\$97,460.00	\$33,626.86	\$8,531.21
	2052 2053	8	Replace (Bridge)	\$189.06	\$3,685,157.52	75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	\$3,685,157.52	\$1,234,464.89	\$301,478.46
	2053	8						8						8						8			
	2055	8						8						8						8			
	2056 2057	8						8						8						8			
	2058	8						8						8						8			
	2059	8						8						8						8			
	2060 2061	8						8						8						8			
	2062	7						7						7						7			
	2063	7						7						7						7			
	2064 2065	7						7						7						7			
	2066	7						7						7						7			
	2067	7						7						7						7			
	2068 2069	7						7						7						7			
	2070	7						7						7						7			
	2071 2072	6	Panair (After Bridge Books)	\$2.00	\$58,476.00	20	. 1	6 7	Panair (After Pridge Penlage)	\$3.00	\$58,476.00	20	<sub>1</sub> 1	6 7	Repair (After Bridge Replace)	\$2.00	\$58,476.00	20	10	6 7	\$175,428.00	\$32,536.97	\$3,708.72
	2072	7 7	Repair (After Bridge Replace)	\$3.00	0.074,000	20	+1	7	Repair (After Bridge Replace)	35.UU	0.00,470.00	20	+1	7	nepair (Arter bridge Repiace)	\$3.00	4/0.00,4	20	+0	7	91/3,440.UU	√5.055,250.	,708.72 ,708.72
	2074	7						7						7						7			
	2075 2076	7						7						7						7			
	2077	7						7						7						7			
	2078	7						7						7						7			
	2079 2080	7						7						7						7			
	2000	,						,						,						Total Cost =	\$6,599,796.28	\$2,720,517.21	\$984,937.95
																				orago Patitar			
C	Comments:										-								Av	erage Rating = End Rating =			
$\dashv$																							
-																							

# LEROUX WASH BR WB (#1773) / I-40 / MP 284.31 OST COMPARISON Present Value 2015 Dollars - Raw Costs COST COMPARISON Present Value 2015 Dollars - Fully Loaded Costs Comparison to Replacement AGENCY COST 7% OPTION AGENCY COST 3% 7% 3% Option **Agency Cost** 3% 7% Option 1 (Replace) \$ 4,036,013.52 \$3,212,645.22 \$2,493,590.27 2 (Rehab) 67.98% 110.12% 158.45% Option 1 (Replace) \$8,879,230 \$7,067,819 \$5,485,899 Option 2 (Rehab) \$ 5,937,068.28 \$2,917,521.11 \$1,573,746.65 118.09% 253.17% 3 (Repair) 61.15% Option 2 (Rehab) \$13,061,550 \$6,418,546 \$3,462,243 Option 3 (Repair) \$ 6,599,796.28 \$2,720,517.21 Option 3 (Repair) \$14,519,552 \$5,985,138 \$2,166,863 Bridge Ratings Per Option **AVG RATING END RATING** OPTION Option 1 (Replace) 6.45 6.18 7 Option 2 (Rehab) 7 Option 3 (Repair) 6.00 **COST COMPARISON RATING COMPARISON** \$7,000,000.00 \$6,000,000.00 Option 1 - Replace Bridge Now \$5,000,000.00 Option 2 - Perform Bridge Rehabilitiation Then Present Value at 7% \$4,000,000.00 Replace ■ Present Value at 3% \$3,000,000.00 Option 3 - Perform Minimum Repairs Then ■ AGENCY COST \$2,000,000.00 **AGENCY COST** \$1,000,000.00 Present Value at 3% Present Value at 7% Option 1 (Replace) Option 2 (Rehab) Option 3 (Repair)

E HOLBROOK TI OP WB (#1370) /	' I-40 / MP 289.	80							
Bridge Information			<b>Deterioration Slope</b>						
Bridge Deck Area (A225)	10934 SF		ltem	Deterioratio	n Line Equation		Year		
Year Built (N27)	1969		item	Slope =	Days	Years	Drop		
Exp Service Life	75 YR		Substr	y =	-0.000195x	-0.071x	14.06		
Total Bridge Length (N49)	268 LF		Superstr	y =	-0.000419x	-0.153x	6.54		
Number of Spans (N45+N46)	3		Deck	y =	-0.000395x	-0.144x	6.94		
Skew Angle (N34)	59 DEG								
Average Elevation	5275 FT								
Max Pier Height	18 FT					Notes:			
* Amount of Widening for Bridge	4 FT		*Input 0 if no widening. Inp	ut should include widening on both sides of		1. Widening	g is intend	ed only to corr	ect lane and/o
Revised Deck Area (Bridge Replace)	12006 FT		bridge if applicable.			shoulder wi	idth deficie	encies. It is no	t intended for
**Scour Critical Rating (N113)	N/A		**If scour critical rating is 3	or lower, Option 2 should consider the		adding traff	ic capacity	(i.e. adding ge	eneral purpose
			implementation of scour co	untermeasures.		lanes).			
Cost Multipliers				L to # Span Multiplier			Skew Mu		
Elevation > 4000ft	5275	1.25		L/ # Span Ratio	Multiplier		Skew	Multiplier	
Pier Height > 30ft	18	1.00		=>100	1.00		<30	1.00	
Length to # span ratio	89.33	1.1		=>60	1.10		=>30	1.10	
Skew > 30degrees	59.00	1.10		<60	1.25				
roject Cost Multiplier	All Options	2.20							
Adjusted Bridge Replace Cost			Elevation Multiplier			Pier H Multi	iplier		
Base Bridge Replacement Cost (Per SF)	\$125.00		Elev	Multiplier		Pier H	Multiplie	er	
	Ψ120.00		<4000	1.00		<30	1.00		
Bridge Replacement Cost w/ Multipliers	\$189.06		=>4000	1.25		=>30	1.10		
(Per SF)	Ψ103.00								
					User input cell				
					Only manipulate cell va	lue after consulti	ng with te	am	

	Bridg	ge History (Inspections/As-builts)			
	Description			Category	Year
Original construction I-40-4(35).					1969
Methacrylate deck seal performed un	der I-040-D(227)T. Therefore, option 2 wi	I not consider deck rehab options.		Rehab (Deck Epoxy Overlay)	2015
Superstructure steel had previously e	chibited cracks as noted in inspection repo	ts. Fatigue prone details also noted. Conside	er rehab in option 2.		
Substructure had rocker bearings rec	ently replaced - assume repairs in option 2	only.			

Replace / Rehab / Repair Inform	nation			
BRIDGE DECK			T	T
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Deck)	Full Deck Replacement	\$94.53	25	Rating = 8
Rehab (Deck Concrete Overlay)	Overlay (Concrete)	\$10.00	15	+ 2
Rehab (Deck Epoxy Overlay)	Overlay (Epoxy)	\$5.00	10	+1
Repair (Deck)	Patch Spalls / Seal Cracks	\$3.00	See Deterioration Slope	+0
Replace (Bridge)	Full Bridge Replacement	\$189.06	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	\$3.00	20	+ 0
Repair (After Rehab)	Patch Spalls / Seal Cracks	\$3.00	10	+0
SUPERSTRUCTURE - STEEL				
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Supr - Stl)	Full SuperStr Replacement	\$94.53	50	Rating = 8
Rehab (Supr - Stl)	Weld New Structural Components	\$47.27	15	+ 2
Repair (Supr - Stl)	Weld Repair / Crack Relief	\$5.00	See Deterioration Slope	+1
			·	
SUPERSTRUCTURE - CONCRETE				
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Supr - Conc)	Full SuperStr Replacement	\$94.53	50	Rating = 8
Rehab (Supr - Conc)	Replace Structural Component	\$47.27	15	+ 2
Repair (Supr - Conc)	Patch Spalls / Seal Cracks	\$5.00	See Deterioration Slope	+1
Replace (Bridge)	Full Bridge Replacement	\$189.06	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	\$3.00	20	+1
Repair (After Rehab)	Patch Spalls / Seal Cracks	\$3.00	10	+1
SUBSTRUCTURE - STRUCTURAL				T
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Substr)	Full SubStr Replacement	\$94.53	75	Rating = 8
Rehab (Substr)	Replace Structural Component	\$47.27	50	+ 2
Repair (Substr)	Patch Spalls / Seal Cracks	\$5.00	See Deterioration Slope	+1
SUBSTRUCTURE - SCOUR				
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Rehab (Substr - Scour)	Add scour protection slabs	\$47.27	50	+ 2
Repair (Substr - Scour)	Patch Spalls / Seal Cracks	\$5.00	See Deterioration Slope	+1
Replace (Bridge)	Full Bridge Replacement	\$189.06	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	\$3.00	20	+1
Repair (After Rehab)	Patch Spalls / Seal Cracks	\$3.00	10	+1

	E HOLBRO	ок ті с	OP WB (#1370) / I-40 /	MP 289.	.80																
			Bridge Now																		
	Pridge D	eck Area =	10934 SF		Notes:	aarli caluma ma	ans surrent h	oridao is nos	aring the end of its expected ser	vice life				Item		terioration Line Equation  Days Years	Year Drop				
		eck Area =							replacement should be selected					Substr	Slope = y =		14.06	1			
		ear Built =			3. Deck Rehab o	does not accour	nt for any dec	k widening	during replacement.					Superstr	y =						
	Exp Sei	vice Life =	75 YR		Widened de     Repair deck				only. deck deterioration of 1 point evo	erv 20 vears.				Deck	y =	= -0.000395x -0.144x	6.94	1			
					sspan activ	,	, 222, 3110411	, p. c. nac u		,,											
		Substructu	<u>re</u>					Superstruct	tur <u>e</u>				Deck						Summary		
		2		Cost (Per	0(71)	6	Rating			Cost (Per	1) 6	Rating			Cost (Per	0/7	Rating	Minimum	Total Cost Per Year	D	B
	Year	Rating	Item	SF)	Cost (Total)	Service Life	Increase	Rating	Item	SF) Cost (Tota	l) Service Life	Increase	Rating	Item	SF)	Cost (Total) Service Life	Increase	Rating	(2015 \$ raw costs)	Present Value at 3%	Present Value at 7%
0	2015	5		-	·			4			<del></del>	-	5				·				
2	2016 2017	5						4					5								
3	2018	5	No Rehab/Repair W	ork Can Be I	Done. Not Yet In 5	-Year Program.		4	No Rehab/Repair W	ork Can Be Done. Not Yet	In 5-Year Progran	1.	5	No Rehab/Repair W	Vork Can Be L	Done. Not Yet In 5-Year Progra	ım.				
4 5	2019 2020	5 5						4					5								
6 7	2021	8	Replace (Bridge)	\$189.06	\$2,269,854.36	75	Rating = 8	8	Replace (Bridge)		75	Rating = 8	8	Replace (Bridge)		75	Rating = 8	8	\$2,269,854.36	\$1,900,967.29	\$1,512,499.80
7 8	2022 2023	8						8					8					8			
9	2024	8						8					8					8			
10	2025	8						8					8					8			
11 12	2026 2027	8						8					8					8			
13	2028	8						8					8					8			
14 15	2029 2030	8						8					8					8			
16	2031	7						7					7					7			
17 18	2032	7 7						7					7					7			
19	2033 2034	7						7					7					7			
20	2035	7						7					7					7			
21 22	2036 2037	7 7						7					7					7			
23	2038	7						7					7					7			
24	2039	7						7					7					7			
25 26	2040 2041	7	Repair (After Bridge Replace)	\$3.00	\$36,018.00	20	+ 1	7	Repair (After Bridge Replace)	\$3.00 \$36,018.0	0 20	+1	7	Repair (After Bridge Replace)	\$3.00	\$36,018.00 20	+0	6 7	\$108,054.00	\$50,104.07	\$18,606.41
27	2042	7						7					7					7			
28 29	2043 2044	7 7						7					7					7			
30	2045	7						7					7					7			
31 32	2046 2047	7						7					7					7			
33	2048	7						7					7					7			
34 35	2049 2050	7						7					7					7			
36	2051	6						6					6					6			
37	2052	6						6					6					6			
38 39	2053 2054	6						6					6					6			
40	2055	6						6					6					6			
41 42	2056 2057	6						6					6					6			
43	2058	6						6					6					6			
44 45	2059 2060	6 5						6 5					6					6 5			
46	2061	6	Repair (After Bridge Replace)	\$3.00	\$36,018.00	20	+1	6	Repair (After Bridge Replace)	\$3.00 \$36,018.0	0 20	+1	6	Repair (After Bridge Replace)	\$3.00	\$36,018.00 20	+0	6	\$108,054.00	\$27,741.41	\$4,808.25
47 48	2062 2063	6						6					6					6			
49	2064	6						6					6					6			
50	2065	6						6					6					6			
51 52	2066 2067	6						6					6					6			
53	2068	6						6					6					6			
54 55	2069 2070	6 5						6 5					6 5					6 5			
56	2071	5						5					5					5			
57 58	2072 2073	5						5					5 5					5 5			
59	2074	5						5					5					5			
60	2075	5						5					5 5					5 5			
61 62	2076 2077	5						5					5					5			
63	2078	5						5					5					5			
64 65	2079 2080	5 5						5					5 5					5			
	2000																	Total Cost =	\$2,485,962.36	\$1,978,812.77	\$1,535,914.46
																	Α.	verage Rating =	6.45		
	Comments:																AV	End Rating =			

	E HOLBRO	ок ті о	OP WB (#1370) / I-40 /	MP 289.	.80																	
	Option 2 -	Perform	Bridge Rehabilitiation Th	nen Repla																		
	Bridge D	eck Area =	10934 SF		Notes:	Vear" column means current	hridge is ne:	aring the end of its expected se	nvice life				-	Item	Slope =	erioration Line Ed	quation Years	Year Drop				
		eck Area =						replacement should be selecte						Substr	y =		-0.071x	14.06				
	Υ	ear Built =	1969			does not account for any de								Superstr	ý =		-0.153x	6.54				
	Exp Ser	vice Life =	75 YR		4. Widened d	eck area applies to bridge re	placement o	only.						Deck	y =	-0.000395x	-0.144x	6.94				
								deck deterioration of 1 point ev														
								point (i.e., if the rating would dr e applied to improve the bridge			Deck would mai	ntain a "5" ai	t that year.)									
					o. For other re	pairiteins, the + value rat	ing should be	e applied to improve the bridge	rating 3 value i	ioi tilat year.												
		Substructur	<u>re</u>				Superstruct	<u>ture</u>					Deck							<u>Summary</u>		
				Cost (Per		Rating			Cost (Per			Rating			Cost (Per			Rating	Minimum	Total Cost Per Year		
	Year	Rating	Item	SF)	Cost (Total)	Service Life Increase	Rating	Item	SF)	Cost (Total)	Service Life	Increase	Rating	ltem	SF)	Cost (Total)	Service Life	Increase	Rating	(2015 \$ raw costs)	Present Value at 3%	Present Value at 7%
0	2015	5				<del></del>	4						5									
1	2016	5					4						5									
3	2017 2018	5	No Rehab/Repair W	ork Can Be	Done. Not Yet In	5-Year Program.	4	No Rehab/Repair V	Work Can Be Do	ne. Not Yet In S	5-Year Program.		5 5	No Rehab/Repair W	Vork Can Be D	one. Not Yet In	5-Year Program	1.				
4	2019	5					4						5									
5	2020	5					4						5									
6	2021	5					6	Rehab (Supr - Stl)	\$47.27	\$516,795.51	15	+ 2	5						5	\$516,795.51	\$432,808.10	\$344,362.67
7 8	2022 2023	5					6						5 5						5			
9	2023	5					6						5						5			
10	2025	5					6						5						5			
11	2026	5					6						5						5			
12 13	2027 2028	5					6						5 5	Repair (Deck)	\$3.00	\$32,802.00	7	+0	5 5	\$32,802.00	\$22,336.57	\$13,611.66
14	2028	4					5						5	nepail (Deck)	الله د د	932,002.UU	,	+0	4	332,002.00	,22,330.31	Ç13,011.00
15	2030	5	Repair (Substr)	\$5.00	\$54,670.00	14 + 1	5						5						5	\$54,670.00	\$35,090.59	\$19,814.92
16	2031	5					5						5						5			
17	2032	5		_			5						5						5			
18 19	2033 2034	5					5						5 5						5			
20	2035	5					5						5						5			
21	2036	5					5						5						5			
22	2037	5					4						5	Repair (Deck)	\$3.00	\$32,802.00	7	+0	4	\$32,802.00	\$17,119.12	\$7,403.84
23 24	2038 2039	5					5	Repair (After Rehab)	\$3.00	\$32,802.00	10	+ 1	5 5						5 5	\$32,802.00	\$16,620.50	\$6,919.48
25	2039	5					5 5						5						5			
26	2041	5					5						5						5			
27	2042	5					5						5						5			
28	2043	5					5						5						5			
29	2044 2045	8	Replace (Bridge)	\$189.06	\$2,269,854.36	75 Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	\$2,269,854.36	\$963,204.44	\$319,057.12
30 31	2045	8					8						8						8			
32	2047	8					8						8						8			
33	2048	8					8						8						8			
34	2049	8					8						8						8			
35 36	2050 2051	8					8						8						8			
37	2051	8					8						8						8			
38	2053	8					8						8						8			
39	2054	7					7						7						7			
40	2055	7					7						7						7			
41 42	2056 2057	7					7						7						7			
43	2058	7					7						7						7			
44	2059	7					7						7						7			
45	2060	7					7						7						7			
46 47	2061 2062	7					7						7						7			
47	2062	6					6						6						6			
49	2064	7	Repair (After Bridge Replace)	\$3.00	\$36,018.00	20 + 1	7	Repair (After Bridge Replace)	\$3.00	\$36,018.00	20	+1	7	Repair (After Bridge Replace)	\$3.00	\$36,018.00	20	+0	7	\$108,054.00	\$25,387.32	\$3,924.96
50	2065	7					7						7						7			
51	2066	7					7						7						7			
52 53	2067 2068	7					7						7						7			
53	2068	7					7						7						7			
55	2070	7					7						7						7			
56	2071	7					7						7						7			
57 58	2072	7					7						7						7			
58	2073 2074	6					6						6						6			
60	2075	6					6						6						6			
61	2076	6					6						6						6			
62	2077	6					6						6						6			
63 64	2078 2079	6					6						6						6			
65	2079	6					6						6						6			
																			Total Cost =	\$3,047,779.87	\$1,512,566.64	\$715,094.66
	Commonto				-				-									Av	erage Rating =		1	
	Comments:																		End Rating =	6		

otion 3 -	Pertorm IVI	inimum Repairs Then		Notes:											Deta	rioration Line Eq	uation					
	eck Area =	10934 SF			'ear" column m	neans current l	bridge is nea	aring the end of its expected se	ervice life.					ltem	Slope =	Days	Years	Year Drop				
	eck Area =	12006 SF						replacement should be selected	ed as well.					Substr	y =	-0.000195x	-0.071x	14.06				
	ear Built = vice Life =	1969 75 YR		Deck Rehab     Widened de				during replacement.						Superstr Deck	y = v =	-0.000419x -0.000395x	-0.153x -0.144x	6.54 6.94				
Exh 26U	vice tile =	/3 K	-					only. deck deterioration of 1 point e	very 20 years.	Repair (Deck) sh	ould maintain d	deck rating for		Deck	y =	-0.000395X	-0.144X	0.94				
				life of repai	ir, if the rating	would otherw	vise drop a p	ooint (i.e., if the rating would d	rop from a "5"	to a "4", Repair [												
				6. For other rep	pair items, the	"+" value ratii	ng should b	e applied to improve the bridg	e rating's valu	e for that year.												
<u> </u>	<u>Substructure</u>						Superstruc	<u>ture</u>				<u></u>	<u>Deck</u>							<u>Summary</u>		
Year	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	ltem	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Minimum Rating	Total Cost Per Year (2015 \$ raw costs)	Present Value at 3%	Present Val
2015 2016	5 5						4						5									
2017 2018	5 5	No Rehab/Repair \	Work Can Be D	one. Not Yet In 5	5-Year Program	n.	4	No Rehab/Repair	Work Can Be D	Done. Not Yet In S	-Year Program.		5	No Rehab/Repair W	ork Can Be D	one. Not Yet In 5	5-Year Program	١.				
2019	5						4						5									
2020 2021	5						5	Repair (Supr - Stl)	\$5.00	\$54,670.00	7	+1	5						5	\$54,670.00	\$45,785.26	\$36,42
2022 2023	5 5						5						5 5						5			
2024	5						5						5						5			
2025 2026	5 5						5 5						5 5						5 5			
2027	5						5						5	Demois (Dest)	62.02	¢22.002.00	-		5	¢22.002.00	t22 226 FT	A
2028 2029	5 4						4 5	Repair (Supr - Stl)	\$5.00	\$54,670.00	7	+1	5 5	Repair (Deck)	\$3.00	\$32,802.00	7	+0	4	\$32,802.00 \$54,670.00	\$22,336.57 \$36,143.31	\$13,61 \$21,20
2030	5	Repair (Substr)	\$5.00	\$54,670.00	14	+1	5						5						5	\$54,670.00	\$35,090.59	\$19,81
2031 2032	5 5						5						5						5 5			
2033 2034	5						5						5 5						5 5			
2035	5						5						5						5			
2036 2037	5 5						4 5	Repair (Supr - Stl)	\$5.00	\$54,670.00	7	+1	5 5	Repair (Deck)	\$3.00	\$32,802.00	7	+0	<u>4</u> 5	\$87,472.00	\$45,650.98	\$19,74
2038	5						5		+5.00	+= ·,0/0.00	,	-	5	(3001)	72.00	+0-,00L100	Í		5	, <u></u>	Ţ,330.30	φ±5,74.
2039 2040	5 5						5 5						5 5						5 5			
2041	5						5						5						5			
2042 2043	5						5						5 5						5 5			
2044	8	Replace (Bridge)	\$189.06	\$2,269,854.36	75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	\$2,269,854.36	\$963,204.44	\$319,05
2045 2046	8						8						8						8			
2047 2048	8						8						8						8			
2049	8						8						8						8			
2050 2051	8						8						8						8			
2052	8						8						8						8			
2053 2054	8 7						8 7						8 7						8 7			
2055	7						7						7						7			
2056 2057	7 7						7						7						7			
2058	7 7						7						7						7			
2059 2060	7						7						7						7			
2061 2062	7						7						7						7			
2063	6						6						6						6			
2064 2065	7 Re	epair (After Bridge Replace)	\$3.00	\$36,018.00	20	+1	7	Repair (After Bridge Replace)	\$3.00	\$36,018.00	20	+1	7 F	Repair (After Bridge Replace)	\$3.00	\$36,018.00	20	+0	7	\$108,054.00	\$25,387.32	\$3,924
2066	7						7						7						7			
2067 2068	7 7						7 7						7 7						7			
2069	7						7						7						7			
2070 2071	7 7						7 7						7						7			
2072 2073	7						7						7						7			
2074	6						6						6						6			
2075 2076	6						6						6						6			
2077	6						6						6						6			
2078	6						6						6						6			
2080	6						6						6						6 Total Cost =	\$2,662,192.36	\$1,173,598.47	\$433,78
																		Av	erage Rating =	6.22		
nments:																			End Rating =	6		

# E HOLBROOK TI OP WB (#1370) / I-40 / MP 289.80 OST COMPARISON Present Value 2015 Dollars - Raw Costs COST COMPARISON Present Value 2015 Dollars - Fully Loaded Costs Comparison to Replacement AGENCY COST 7% OPTION AGENCY COST 3% 7% 3% Option **Agency Cost** 3% 7% Option 1 (Replace) \$ 2,485,962.36 \$1,978,812.77 \$1,535,914.46 2 (Rehab) 81.57% 130.82% 214.78% Option 1 (Replace) \$5,469,117 \$4,353,388 \$3,379,012 Option 2 (Rehab) \$ 3,047,779.87 \$1,512,566.64 93.38% 168.61% 354.07% \$3,327,647 \$715,094.66 3 (Repair) Option 2 (Rehab) \$6,705,116 \$1,573,208 Option 3 (Repair) | \$ 2,662,192.36 | \$1,173,598.47 Option 3 (Repair) \$5,856,823 \$2,581,917 \$954,323 Bridge Ratings Per Option **AVG RATING END RATING** OPTION Option 1 (Replace) 6.45 6.23 6 Option 2 (Rehab) Option 3 (Repair) 6.22 6 **COST COMPARISON RATING COMPARISON** \$3,500,000.00 \$3,000,000.00 Option 1 - Replace Bridge Now \$2,500,000.00 Option 2 - Perform Bridge Rehabilitiation Then Present Value at 7% \$2,000,000.00 Replace ■ Present Value at 3% \$1,500,000.00 Option 3 - Perform Minimum Repairs Then ■ AGENCY COST \$1,000,000.00 **AGENCY COST** \$500,000.00 Present Value at 3% Present Value at 7% Option 1 (Replace) Option 2 (Rehab) Option 3 (Repair)

E HOLBROOK TI OP EB (#1369) /	I-40 / MP 289.8	0							
Bridge Information			<b>Deterioration Slope</b>						
Bridge Deck Area (A225)	10934 SF		ltem	Deterioratio	n Line Equation		Year		
Year Built (N27)	1969		item	Slope =	Days	Years	Drop		
Exp Service Life	75 YR		Substr	y =	-0.000262x	-0.096x	10.45		
Total Bridge Length (N49)	268 LF		Superstr	y =	-0.000533x	-0.194x	5.15		
Number of Spans (N45+N46)	3		Deck	y =	-0.000507x	-0.185x	5.40		
Skew Angle (N34)	61 DEG								
Average Elevation	5275 FT								
Max Pier Height	17 FT					Notes:			
* Amount of Widening for Bridge	4 FT		*Input 0 if no widening. Inp	ut should include widening on both sides of	1. Widenin	ed only to corr	ect lane and/		
Revised Deck Area (Bridge Replace)	12006 FT		bridge if applicable.			shoulder wi	idth deficie	encies. It is no	t intended fo
**Scour Critical Rating (N113)	N/A		**If scour critical rating is 3	or lower, Option 2 should consider the		adding traff	ic capacity	(i.e. adding ge	eneral purpos
			implementation of scour co	ountermeasures.		lanes).			
Cost Multipliers				L to # Span Multiplier			Skew Mu		
Elevation > 4000ft	5275	1.25		L/ # Span Ratio	Multiplier		Skew	Multiplier	
Pier Height > 30ft	17	1.00		=>100	1.00		<30	1.00	
Length to # span ratio	89.33	1.1		=>60	1.10		=>30	1.10	
Skew > 30degrees	61.00	1.10		<60	1.25				
roject Cost Multiplier	All Options	2.20							
djusted Bridge Replace Cost			Elevation Multiplier			Pier H Multip			
Base Bridge Replacement Cost (Per SF) \$125.00			Elev	Multiplier		Pier H	Multiplie	er	
suse shage replacement cost (i ci si )	Ÿ123.00		<4000	1.00		<30	1.00		
ridge Replacement Cost w/ Multipliers	\$189.06		=>4000	1.25		=>30	1.10		
(Per SF)	7103.00								
					User input cell				
					Only manipulate cell va	lue after consulti	ng with te	am	

		Bridge History	(Inspections/As-b	uilts)							
		Description						Categ	gory		Year
Original construction I-40-4(35).											1969
Methacrylate deck seal performed unde	1-040-D(227)T. Therefore	e, option 2 will not consid	der deck rehab optio	ns.			Rehab ([	Deck Ep	oxy Ove	rlay)	2015
Superstructure steel had previously exh	bited cracks as noted in ins	pection reports. Fatigue	e prone details also n	oted. Conside	er rehab ir	n option 2.					
Substructure had rocker bearings recen	ly replaced - assume repai	rs in option 2 only.									

Replace / Rehab / Repair Inforn	nation			
BRIDGE DECK				
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Deck)	Full Deck Replacement	\$94.53	25	Rating = 8
Rehab (Deck Concrete Overlay)	Overlay (Concrete)	\$10.00	15	+2
Rehab (Deck Epoxy Overlay)	Overlay (Epoxy)	\$5.00	10	+1
Repair (Deck)	Patch Spalls / Seal Cracks	\$3.00	See Deterioration Slope	+0
Replace (Bridge)	Full Bridge Replacement	\$189.06	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	\$3.00	20	+0
Repair (After Rehab)	Patch Spalls / Seal Cracks	\$3.00	10	+0
SUPERSTRUCTURE - STEEL			<u> </u>	
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Supr - Stl)	Full SuperStr Replacement	\$94.53	50	Rating = 8
Rehab (Supr - Stl)	Weld New Structural Components	\$47.27	15	+2
Repair (Supr - Stl)	Weld Repair / Crack Relief	\$5.00	See Deterioration Slope	+1
SUPERSTRUCTURE - CONCRETE				
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Supr - Conc)	Full SuperStr Replacement	\$94.53	50	Rating = 8
Rehab (Supr - Conc)	Replace Structural Component	\$47.27	15	+ 2
Repair (Supr - Conc)	Patch Spalls / Seal Cracks	\$5.00	See Deterioration Slope	+1
Replace (Bridge)	Full Bridge Replacement	\$189.06	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	\$3.00	20	+1
Repair (After Rehab)	Patch Spalls / Seal Cracks	\$3.00	10	+1
SUBSTRUCTURE - STRUCTURAL				
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Substr)	Full SubStr Replacement	\$94.53	75	Rating = 8
Rehab (Substr)	Replace Structural Component	\$47.27	50	+ 2
Repair (Substr)	Patch Spalls / Seal Cracks	\$5.00	See Deterioration Slope	+1
SUBSTRUCTURE - SCOUR				
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Rehab (Substr - Scour)	Add scour protection slabs	\$47.27	50	+ 2
Repair (Substr - Scour)	Patch Spalls / Seal Cracks	\$5.00	See Deterioration Slope	+1
Replace (Bridge)	Full Bridge Replacement	\$189.06	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	\$3.00	20	+1
Repair (After Rehab)	Patch Spalls / Seal Cracks	\$3.00	10	+1

k Area = 120 ir Built = 1 ce Life = 7:			Notes:  1. Red fill in "Yes	structure replac does not accour	cement is sele	cted, decl	earing the end of its expected serv k replacement should be selected						<b>Item</b> Substr	Dete Slope = y =	Prioration Line Equation  Days Years  -0.000262x -0.096x	Year Drop				
k Area = 109 k Area = 120 ur Built = 1 ce Life = 7:	34 SF 06 SF 969		Red fill in "Yes     When superst     Deck Rehab do	structure replac does not accour	cement is sele	cted, decl	k replacement should be selected							Slope =	Days Years					
k Area = 120 ir Built = 1 ce Life = 7:	06 SF 969		When superst     Deck Rehab do	structure replac does not accour	cement is sele	cted, decl	k replacement should be selected													
r Built = 1 ce Life = 7!	969		3. Deck Rehab do	does not accour				as well.					Substr	v =	-0.000262v -0.096v	10.45				
ce Life = 75					nt for any deck	k widenin	and the state of the second state of													
bstructure	YR		<ol> <li>4. Widened dec</li> </ol>										Superstr	y =		5.15				
								20					Deck	y =	-0.000507x -0.185x	5.40				
			ъ. кераir deck (г	arcer bridge re	¿piace) should	i provide a	a deck deterioration of 1 point eve	ry zu years.												
Rating It						Superstrue	cture					Deck						<u>Summary</u>		
Rating It		Cost (Per			Rating			Cost (Per			Rating			Cost (Per		Rating	Minimum	Total Cost Per Year		
	em	SF)	Cost (Total)	Service Life	Increase	Rating	Item	SF)	Cost (Total)	Service Life	Increase	Rating	Item	SF)	Cost (Total) Service Life	Increase	Rating	(2015 \$ raw costs)	Present Value at 3%	Present Value
5						4						6								
5						4						6								
5 No	Rehab/Repair Wo	ork Can Be Do	Done. Not Yet In 5-	-Year Program	i. 1	4	No Rehab/Repair Wo	ork Can Be D	Oone. Not Yet In 5	5-Year Program.		6	No Rehab/Repair Wo	ork Can Be D	one. Not Yet In 5-Year Program	1.				
5						4 4						6								
5					/	4						6								
8 Replace	(Bridge)	\$189.06	\$2,269,854.36	75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	Replace (Bridge)		75	Rating = 8	8	\$2,269,854.36	\$1,900,967.29	\$1,512,49
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6 7 Panair (After	ridge Penlace)	\$2.00	\$26,019,00	20	±1	6 7	Panair (After Bridge Panlace)	\$2.00	\$26 M 9 M	20	±1	6 7	Panair (After Bridge Panlace)	\$2.00	\$26,019,00 20	+0		\$109.054.00	\$50.104.07	\$18,606
7 Nepali (Alter	riuge Replace)	\$3.00	\$30,018.00	20	71	7	Repair (Arter Bridge Replace)	\$3.00	\$30,018.00	20	* 1	7	Repair (Arter bridge Replace)	\$3.00	\$30,018.00 Z0	+0	7	\$100,034.00	\$30,104.07	318,000.
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6 Renair (After	ridge Renlace)	\$3.00	\$36.018.00	20	+1	6	Repair (After Bridge Replace)	\$3.00	\$36 018 M	20	+ 1	6	Repair (After Bridge Replace)	\$3.00	\$36.018.00 20	+0		\$108.054.00	\$27 741 41	\$4,808.
6	age ricpidce)	Ç3.00	Ç50,010.00	20		6		Ç3.00	\$50,010.00	2.0		6	pan (rinter bridge hepiace)	Ç3.00	200,010.00 20		6	Ç100,034.00	YE1,171.71	,44,0UO.
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5				<del></del>	<del></del>	5						5					Total Cost =	\$2,485,962.36	\$1,978,812.77	\$1,535,91
5																		Y=,703,302.30	V-1010101E-11	71,333,71
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5 5																Ave	erage Rating =			
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	Replace  Replace	8 Replace (Bridge) 8 8 8 8 8 8 8 8 8 7 7 7 7 7 7 7 7 7 7 7	8 Replace (Bridge) \$189.06 8 8 8 8 8 8 8 8 8 8 8 7 7 7 7 7 7 7 7	8 Replace (Bridge) \$189.06 \$2,269,854.36 8 8	8 Replace (Bridge) \$189.06 \$2,269,854.36 75 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	8 Replace (Bridge) \$189.06 \$2,269,854.36 75 Rating = 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 7 7 7 7	8         Replace (Bridge)         \$189.06         \$2,269,854.36         75         Rating=8         8	8 Replace (Bridge)	Replace (Bridge)  \$189.06 \$2,269,854.36 75	Replace (Bridge)	8 Replace (Bridger)   \$189.06   \$2,269,854.36   75   Rating = 8   8   Replace (Bridger)   75   8   8   8   8   8   8   8   8   8	8 Replace (Biridge)	Replace (Bridge)   S189.06   S2,209,854.36   75   Rating = B   8   8   8   8   8   8   8   8   8	Regulace (Inridge) \$180.00 \$2,260,654.36 73 Rating = 8   Reprises (Inridge)   75 Rating = 8   Rati	Replace (Bridge)   \$180.00   \$2,200.054.36   72   Bating = 8   Replace (Bridge)   75   Rating = 8   Replace (Bridge)	## Register (Missinger)   Satistic   Satisti	Registro (Infoge)	Replace (Bridger)  200 06	Property   Property	Section   Sect

	E HOLBRO	ок ті о	P EB (#1369) / I-40 / N	MP 289.8	80																	
	Option 2 -	Perform	Bridge Rehabilitiation Th	nen Repla																		
	Bridge De	eck Area =	10934 SF		Notes:	ear" column means current	hridge is ne	earing the end of its expected se	nvice life				-	Item	Slope =	erioration Line Ed	quation Years	Year Drop				
		eck Area =	12006 SF					replacement should be selecte						Substr	y =		-0.096x	10.45				
	Y	ear Built =	1969			does not account for any d								Superstr	ý =	-0.000533x	-0.194x	5.15				
	Exp Ser	vice Life =	75 YR			eck area applies to bridge re								Deck	y =	-0.000507x	-0.185x	5.40				
								deck deterioration of 1 point ev														
								point (i.e., if the rating would dr e applied to improve the bridge			Jeck would mail	ntain a "5" at	t that year.)									
					o. For other re	parriteriis, the . value ru	ing should b	e applied to improve the bridge	. ruting 3 value i	ioi tiiut yeur.												
	2	Substructur	<u>e</u>				Superstruc	ture					<u>Deck</u>							<u>Summary</u>		
				Cost (Per		Rating			Cost (Per			Rating			Cost (Per			Rating	Minimum	Total Cost Per Year		
	Year	Rating	Item	SF)	Cost (Total)	Service Life Increase	Rating	Item	SF)	Cost (Total)	Service Life	Increase	Rating	Item	SF)	Cost (Total)	Service Life	Increase	Rating	(2015 \$ raw costs)	Present Value at 3%	Present Value at 7%
0	2015	5			*	· · · · · · · · · · · · · · · · · · ·	4						6				_					
1	2016	5					4						6									
2	2017 2018	5	No Rehab/Repair W	ork Can Be	Done. Not Yet In	5-Year Program.	4 4	No Rehab/Repair V	Work Can Be Do	ne. Not Yet In S	5-Year Program.		6	No Rehab/Repair W	Vork Can Be D	one. Not Yet In	5-Year Progran	1.				
4	2019	5					4						6									
5	2020	5					4				<u> </u>		6									
6	2021	5					6	Rehab (Supr - Stl)	\$47.27	\$516,795.51	15	+ 2	5						5	\$516,795.51	\$432,808.10	\$344,362.67
7	2022 2023	5					6						5						5			
9	2023	5					6						5						5			
10	2025	5					6						5	Repair (Deck)	\$3.00	\$32,802.00	5	+0	5	\$32,802.00	\$24,407.77	\$16,674.87
11	2026	5					6						5						5			
12 13	2027 2028	5					6						5						5			
13	2028	5					5						5						5			
15	2030	5					5						5						5			
16	2031	4					5						5	Repair (Deck)	\$3.00	\$32,802.00	5	+0	4	\$32,802.00	\$20,441.12	\$11,111.17
17	2032	5	Repair (Substr)	\$5.00	\$54,670.00	10 +1	5						5						5	\$54,670.00	\$33,076.25	\$17,307.12
18 19	2033 2034	5					5						5 5						5 5			
20	2035	5					5						5						5			
21	2036	5					5						5	Repair (Deck)	\$3.00	\$32,802.00	5	+0	5	\$32,802.00	\$17,632.69	\$7,922.11
22	2037	5					4						5						4			
23 24	2038 2039	5 5					5	Repair (After Rehab)	\$3.00	\$32,802.00	10	+1	5 5						5 5	\$32,802.00	\$16,620.50	\$6,919.48
25	2040	5					5						5						5			
26	2041	4					5						5	Repair (Deck)	\$3.00	\$32,802.00	5	+0	4	\$32,802.00	\$15,210.11	\$5,648.36
27	2042	5	Repair (Substr)	\$5.00	\$54,670.00	10 + 1	5						5						5	\$54,670.00	\$24,611.84	\$8,798.06
28	2043	5 8	Danier (Drider)	Ć100.0C	¢2 200 054 20	75 Pating 0	5	Darless (Drides)			75	Datina - 0	5	Douloss (Drides)			75	Dating 0	5 8	\$2,269,854.36	¢0C2 204 44	Ć240.057.42
29 30	2044 2045	8	Replace (Bridge)	\$189.06	\$2,269,854.36	75 Rating = 8	8	Replace (Bridge)			75	Rating = 8	8 8	Replace (Bridge)			75	Rating = 8	8	\$2,209,854.30	\$963,204.44	\$319,057.12
31	2046	8					8						8						8			
32	2047	8					8						8						8			
33	2048	8					8						8						8			
34 35	2049 2050	8					8						8						8			
36	2051	8					8						8						8			
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39 40	2054 2055	7					7						7						7			
41	2056	7					7						7						7			
42	2057	7					7						7						7			
43	2058	7					7						7						7			
44 45	2059 2060	7					7						7						7			
46	2061	7					7						7						7			
47	2062	7					7						7						7			
48	2063	6					6						6						6			
49	2064	7	Repair (After Bridge Replace)	\$3.00	\$36,018.00	20 + 1	7	Repair (After Bridge Replace)	\$3.00	\$36,018.00	20	+ 1	7	Repair (After Bridge Replace)	\$3.00	\$36,018.00	20	+0	7	\$108,054.00	\$25,387.32	\$3,924.96
50 51	2065 2066	7					7						7						7			
52	2067	7					7						7						7			
53	2068	7					7						7						7			
54	2069	7					7						7						7			
55 56	2070 2071	7					7						7						7			
55	2071	7					7						7						7			
58	2073	7					7						7						7			
59	2074	6					6						6						6			
60 61	2075 2076	6					6						6						6			
62	2076	6					6						6						6			
63	2078	6					6						6						6			
64	2079	6					6						6						6			
65	2080	6					6						6						6	\$2.4C0.0F2.07	61 572 400 45	6744 735 00
																			Total Cost =	\$3,168,053.87	\$1,573,400.15	\$741,725.93
																		Av	erage Rating =	6.22		
	Comments:																		End Rating =			

OK II OP I	EB (#1369) / I-40 / N	/IP 289.8	80																		
erform Mi	inimum Repairs Then F	Replace																			
al. A see a	10024.05		Notes:										Item		rioration Line Eq		Year Drop				
													Substr				10.45				
ar Built =	1969							_ 30 ******					Superstr	y - y =	-0.000202X -0.000533x	-0.194x	5.15				
ice Life =	75 YR		4. Widened de	eck area applies to	o bridge repla	acement onl	ly.						Deck	y =	-0.000507x	-0.185x	5.40				
										Deck would mai	ntaın a "5" at	tnat year.									
			6. For other re	pairiteins, the +	value rating	g siloulu be a	applied to improve the bridge	rating 5 value	ioi tiiat year.												
ubstructure .					<u>s</u>	Superstructui	<u>re</u>					<u>Deck</u>							<u>Summary</u>		
Datina	lès	Cost (Per	Cook (Total)	Camilaa lifa	Rating	Datina	14	Cost (Per	C+ (T-+-!)	Camilas life	Rating	Dati	là a	Cost (Per	Coat (Total)	Camilas life	Rating	Minimum	Total Cost Per Year	Descript Value at 20/	Dunnant Value o
Kating	item	SF)	Cost (Total)	Service Life	Increase	Kating	item	SF)	Cost (Total)	Service Life	Increase	Kating	item	SF)	Cost (Total)	Service Life	Increase	Rating	(2015 \$ raw costs)	Present value at 3%	Present Value a
5						4						6									
5																					
5	No Rehab/Repair W	ork Can Be I	Done. Not Yet In !	5-Year Program.		4	No Rehab/Repair V	ork Can Be D	one. Not Yet In !	5-Year Program	•	6	No Rehab/Repair W	ork Can Be D	one. Not Yet In 5	-Year Program					
5						4						6									
-							Renair (Sunr - Stl)	\$5.00	\$54,670,00	5	+1							5	\$54,670,00	\$45.785.26	\$36,428.93
5						5	nepair (Jupi - Ju)	Ş5.00	<i>₽</i> ,070.00	, ,	. 1	5						5	Ş5 <del>-</del> ,070.00	ÇT3,763.20	230,420.93
5						5						5						5			
5						5						5	Developed 13	42.00	ć22 000 00	_		5	422 000 00	424 :07 ==	A.c. cm
5						4	Renair (Sunr - Stl)	\$5.00	\$54 670 00	5	+1		Repair (Deck)	\$3.00	\$32,802.00	5	+0				\$16,674.87 \$25,973.32
5						5	nepon (Jupi Juj	Ç5.00	Ç3 1,37 0.00			5						5	\$5.,070.00	Ç55, <del>151.</del> 11	Ş23,313.32
5						5						5						5			
5						5						5						5			
4						5	Repair (Supr - Stl)	\$5.00	\$54 670 M	5	+ 1	5	Repair (Deck)	\$3.00	\$32 802 00	5	+0		\$87 472 00	\$54 509 66	\$29,629.79
5	Repair (Substr)	\$5.00	\$54,670.00	10	+1	5	nepair (Jupi - Ju)	Ş3.00	,57,070.00	,	. 1	5	ricpan (Deck)	Ç3.00	JJ2,002.00	, ,	. 0	5	\$54,670.00	\$33,076.25	\$17,307.1
5	, , ,					5						5						5			
5						5						5						5			
5						5	Repair (Supr - Stl)	\$5.00	\$54 670 M	5	+ 1	5	Repair (Deck)	\$3.00	\$32 802 00	5	+0	4 5	\$87 472 00	\$47 020 51	\$21,125.6
5						5	nepair (Jupi - Ju)	Ş3.00	Ç5 7,070.00			5	(Deck)	Ç3.00	φ <b>υ</b> Σ,002.00	,		5	907,472.00	Ç47,020.31	γε1,123.0
5						5						5						5			
5						5						5						5			
4						5	Repair (Supr - Stl)	\$5.00	\$54,670.00	5	+ 1	5	Repair (Deck)	\$3.00	\$32,802.00	5	+0		\$87,472.00	\$40,560.31	\$15,062.2
5	Repair (Substr)	\$5.00	\$54,670.00	10	+ 1	5		<b>41.00</b>	+2 .,5,0.00			5		75.00	702,000			5	\$54,670.00	\$24,611.84	\$8,798.06
5						5						5						5			
8	Replace (Bridge)	\$189.06	\$2,269,854.36	75 R	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	\$2,269,854.36	\$963,204.44	\$319,057.1
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6	main (After D. M D	62.62	620.040.00	20		6	Danais (After Division Divisio	62.00	¢20 040 00	20		6	Danaia (After Diller D	62.00	¢26.040.00	20		6	\$400.0E4.00	625.207.22	An no : -
7 Re	pair (Aπer Bridge Replace)	\$3.00	\$36,018.00	20	+1	7 F 7	kepair (After Bridge Replace)	\$3.00	\$36,018.00	20	+1	7	kepair (Atter Bridge Replace)	\$3.00	\$36,018.00	20	+0	7	\$108,054.00	\$25,387.32	\$3,924.9
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7 7 7 7 7 7 6 6 6 6 6 6						7 7 7 6 6 6 6 6 6						6 6 6 6 6 6						7 6 6 6 6 6 6			
7 7 7 7 7 7 6 6 6 6 6 6 6						7 7 7 6 6 6 6 6 6						6 6 6 6 6 6						7 6 6 6 6 6	\$2,891,806.36	\$1,298,058.12	\$493,982.1
7 7 7 7 7 7 7 6 6 6 6 6 6 6						7 7 7 6 6 6 6 6 6 6						7 6 6 6 6 6 6						7 6 6 6 6 6 6 6 7 Total Cost =		\$1,298,058.12	\$493,982.1
7 7 7 7 7 7 7 7 6 6 6 6 6 6 6 6 6 6						7 7 7 7 6 6 6 6 6 6 6						7 6 6 6 6 6 6						7 6 6 6 6 6 6 7 Total Cost =	6.17	\$1,298,058.12	\$493,982.:
7 7 7 7 7 7 7 7 6 6 6 6 6 6 6 6 6 6						7 7 7 6 6 6 6 6 6 6 6						7 6 6 6 6 6 6						7 6 6 6 6 6 6 6 7 Total Cost =	6.17	\$1,298,058.12	\$493,982.
7 7 7 7 7 7 7 6 6 6 6 6 6 6 6 6						7 7 7 7 6 6 6 6 6 6 6 6 6 6						7 6 6 6 6 6 6 6						7 6 6 6 6 6 6 7 Total Cost =	6.17	\$1,298,058.12	\$493,982
aric R	bstructure Rating  5 5 5 5 5 5 5 5 5 5 5 5 5 7 7 7 7 7 7	Repair (Substr)   S   S   S   S   S   S   S   S   S	K Area = 12006 SF  1 Built = 1969  20 Life = 75 YR		1. Red fill in "Year" column mea	1. Red fill in "Veran" column means current by Ariea = 12006 SF   2. When superstructure replacement is sete   2. When superstructure replacement is sete   3. Deck Rehab does not account for any deck   4. Widened deck area applies to bridge replace) should life of repair, if the rating would otherwise   5. Repair deck (after bridge replace) should life of repair, if the rating would otherwise   6. For other repair items, the "-" value ratin   6. For other ratin   6. For other ratin   6. For other ratin   6. For other ra	Ace a =   10034 SF	A.	Ace   10934   5	A. Rea   1,0263   5	A A Page   10934 SF	1.   1.   1.   1.   1.   1.   1.   1.		Manual   M	March   1998  35	March   Marc	March   Marc	March   Marc	March   Marc	March   Marc	Section   Sect

#### E HOLBROOK TI OP EB (#1369) / I-40 / MP 289.80 OST COMPARISON Present Value 2015 Dollars - Raw Costs COST COMPARISON Present Value 2015 Dollars - Fully Loaded Costs Comparison to Replacement AGENCY COST 7% OPTION AGENCY COST 3% 7% 3% Option **Agency Cost** 3% 7% Option 1 (Replace) \$ 2,485,962.36 \$1,978,812.77 \$1,535,914.46 2 (Rehab) 78.47% 125.77% 207.07% Option 1 (Replace) \$5,469,117 \$4,353,388 \$3,379,012 Option 2 (Rehab) \$ 3,168,053.87 \$1,573,400.15 85.97% 152.44% 310.93% \$741,725.93 3 (Repair) Option 2 (Rehab) \$6,969,719 \$3,461,480 \$1,631,797 Option 3 (Repair) \$ 2,891,806.36 \$1,298,058.12 Option 3 (Repair) \$6,361,974 \$2,855,728 \$1,086,761 Bridge Ratings Per Option **AVG RATING END RATING** OPTION Option 1 (Replace) 6.45 6.22 6 Option 2 (Rehab) Option 3 (Repair) 6.17 6 **COST COMPARISON RATING COMPARISON** \$3,500,000.00 \$3,000,000.00 Option 1 - Replace Bridge Now \$2,500,000.00 Option 2 - Perform Bridge Rehabilitiation Then Present Value at 7% \$2,000,000.00 Replace ■ Present Value at 3% \$1,500,000.00 Option 3 - Perform Minimum Repairs Then ■ AGENCY COST \$1,000,000.00 **AGENCY COST** \$500,000.00 Present Value at 3% Present Value at 7% Option 1 (Replace) Option 2 (Rehab) Option 3 (Repair)

PAINTED DESERT TI UP (#590) / I-	-40 / MP 311.57	•							
Bridge Information			Deterioration Slope						
Bridge Deck Area (A225)	8750 SF		Itom	Deterioratio	n Line Equation		Year		
Year Built (N27)	1961		iteiii	Slope =	Days	Years	Drop		
Exp Service Life	75 YR		Substr	y =	-0.000988x	-0.361x	2.77		
Total Bridge Length (N49)	250 LF		Superstr	y =	-0.000137x	-0.050x	20.00		
Number of Spans (N45+N46)	4		Deck	y =	-0.000137x	-0.050x	20.00		
Skew Angle (N34)	0 DEG								
Average Elevation	5752 FT								
Max Pier Height	20 FT					Notes:			
Bridge Deck Area (A225) 8750 SF    Item   Slope = Days   Year Drop	ed only to corr	rect lane and/							
	shoulder wi	idth defici	encies. It is no	t intended fo					
**Scour Critical Rating (N113)	N/A		**If scour critical rating is 3	or lower, Option 2 should consider the		adding traff	ic capacity	(i.e. adding ge	eneral purpos
			implementation of scour co	ountermeasures.		lanes).			
							01 00	1 1.	
•		1							
								Multiplier	
							_	1.00	
							=>30	1.10	
				<60	1.25				
roject Cost Multiplier	All Options	2.20							
diusted Bridge Penlace Cost			Flavation Multiplier			Dier H Multi	inlier		
lajusteu Bridge Replace Cost			•	Multiplior			•	<u> </u>	
Base Bridge Replacement Cost (Per SF)	\$125.00			·					
ridge Renlacement Cost w/ Multipliers									
	\$171.88		-> 1000	1.25		->50	2.10		
					User input cell				
					Only manipulate cell va	lue after consulti	ng with te	am	

				Bridge	History (I	Inspections/	As-builts)						
				Description						Cate	egory		Year
Bridge originally	built I-40-5(7)												1961
New handrail de	tails I-40-5(38)												1973
BR-040-E(206)T:													2014
1. Deck replace	ement									Replac	e (Deck)		
2. Superstructi	ure replacement								R	eplace (	(Supr - St	tl)	
Deck and supers	tructure are in very	good condition since	having been	replaced in 2	2014. Ther	refore, a 20-ye	ar drop is assı	ımed.					
Given the 2014 \	work, Option 2 has a	lready taken place fo	r superstruc	ture/deck. Si	ubstructur	e evaluated or	nly.						

Replace / Rehab / Repair Inform	nation			
nepraec y nemas y nepan mjern				
BRIDGE DECK				Į.
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Deck)	Full Deck Replacement	\$85.94	25	Rating = 8
Rehab (Deck Concrete Overlay)	Overlay (Concrete)	\$10.00	15	+ 2
Rehab (Deck Epoxy Overlay)	Overlay (Epoxy)	\$5.00	10	+1
Repair (Deck)	Patch Spalls / Seal Cracks	\$3.00	See Deterioration Slope	+0
Replace (Bridge)	Full Bridge Replacement	\$171.88	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	\$3.00	20	+0
Repair (After Rehab)	Patch Spalls / Seal Cracks	\$3.00	10	+0
SUPERSTRUCTURE - STEEL				<u> </u>
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Supr - Stl)	Full SuperStr Replacement	\$85.94	50	Rating = 8
Rehab (Supr - Stl)	Weld New Structural Components	\$42.97	15	+ 2
Repair (Supr - Stl)	Weld Repair / Crack Relief	\$5.00	See Deterioration Slope	+1
SUPERSTRUCTURE - CONCRETE				
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Supr - Conc)	Full SuperStr Replacement	\$85.94	50	Rating = 8
Rehab (Supr - Conc)	Replace Structural Component	\$42.97	15	+ 2
Repair (Supr - Conc)	Patch Spalls / Seal Cracks	\$5.00	See Deterioration Slope	+1
Replace (Bridge)	Full Bridge Replacement	\$171.88	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	\$3.00	20	+1
Repair (After Rehab)	Patch Spalls / Seal Cracks	\$3.00	10	+1
SUBSTRUCTURE - STRUCTURAL				
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Substr)	Full SubStr Replacement	\$85.94	<b>7</b> 5	Rating = 8
Rehab (Substr)	Replace Structural Component	\$42.97	50	+ 2
Repair (Substr)	Patch Spalls / Seal Cracks	\$5.00	See Deterioration Slope	+1
SUBSTRUCTURE - SCOUR				
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Rehab (Substr - Scour)	Add scour protection slabs	\$42.97	50	+ 2
Repair (Substr - Scour)	Patch Spalls / Seal Cracks	\$5.00	See Deterioration Slope	+1
Replace (Bridge)	Full Bridge Replacement	\$171.88	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	\$3.00	20	+1
Repair (After Rehab)	Patch Spalls / Seal Cracks	\$3.00	10	+ 1

	DESERT	TI UP (#590) / I-40 / N	IP 311.57	7																	
		Bridge Now																			
- p 1 -	piace i			Notes:										the e	Dete	erioration Line Equation	V				
	Deck Area =			1. Red fill in "Ye				earing the end of its expected servi						ltem -	Slope =	Days Years	Year Drop				
	Deck Area =	10708 SF						replacement should be selected a	as well.					Substr	y =		2.77				
	Year Built =	1961						g during replacement.						Superstr	y =		20.00				
Exp Sei	rvice Life =	75 YR		4. Widened ded					. 20					Deck	y =	-0.000137x -0.050x	20.00				
				5. Kepair deck (	arter bridge re	epiace) snouid	provide a	deck deterioration of 1 point ever	ry 20 years.												
	Substructure	r <u>e</u>					Superstruc	cture				L	Deck						Summary		
			Cost (Per			Rating			Cost (Per			Rating			Cost (Per		Rating	Minimum	Total Cost Per Year		
Year	Rating	Item	SF)	Cost (Total)	Service Life	Increase	Rating	Item	SF)	Cost (Total)	Service Life	Increase	Rating	Item	SF)	Cost (Total) Service Life	Increase	Rating	(2015 \$ raw costs)	Present Value at 3%	Present Value at
2015	6						8						8								
2016	6						8						8								
2017	6	No Rehab/Repair W	ork Can Bo F	one Not Vet In E	Voor Brogram		8	No Rehab/Repair Wo	ork Can Bo D	one Not Vet In E	- Voor Program		8	No Pohah/Ponair We	ork Can Bo F	Done. Not Yet In 5-Year Program	<b>m</b>				
2018	6	No Kenab/Kepan Vi	OIR CUII DC D	one. Not return	real riogram		8	140 Heriab/Hepair 440	ork call be b	one. Not ret in s	rear rogram.		8	No henas/hepan we	ork can be b	Jone: Not retin 5-real riogial	***				
2019 2020	6						8						8								
2020	8	Replace (Bridge)	\$171.88	\$1,840,405.10	75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8	Replace (Bridge)		75	Rating = 8	8	\$1,840,405.10	\$1,541,310.30	\$1,226,339.6
2022	8	ricpiace (bridge)	Ş171.00	\$1,040,403.10	,,,	Nating - 0	8	neplace (bridge)			,,,	rating - 0	8	neprace (bridge)		73	racing - 0	8	\$1,040,403.10	\$1,541,510.50	Ç1,220,333.0.
2023	8						8						8					8			
2024	8						8						8					8			
2025	8						8						8					8			
2026	8						8						8					8			
2027 2028	8						8						8					8			
2028	8						8						8					8			
2030	8						8						8					8			
2031	7						7						7					7			
2032	7						7						7					7			
2033	7						7						7					7			
2034 2035	7						7						7					7			
2036	7						7						7					7			
2037	7						7						7					7			
2038	7						7						7					7			
2039	7						7						7					7			
2040	6		40.00	400 400 50			6		40.00	400 100 00			7		40.00	400 400 50		6	400 000 00	4.1.50=.10	440 =040
2041 2042	7	Repair (After Bridge Replace)	\$3.00	\$32,122.50	20	+1	7 7	Repair (After Bridge Replace)	\$3.00	\$32,122.50	20	+1	7	Repair (After Bridge Replace)	\$3.00	\$32,122.50 20	+0	7	\$96,367.50	\$44,685.10	\$16,594.05
2042	7						7						7					7			
2044	7						7						7					7			
2045	7						7						7					7			
2046	7						7						7					7			
2047	7						7						7					7			
2048 2049	7						7						7					7			
2050	7						7						7					7			
2051	6						6						6					6			
2052	6						6						6					6			
2053	6						6						6					6			
2054	6						6						6					6			
2055 2056	6						6						6					6			
2057	6						6						6					6			
2058	6						6						6					6			
2059	6						6						6					6			
2060	5						5						6					5			
2061	6	Repair (After Bridge Replace)	\$3.00	\$32,122.50	20	+1	6	Repair (After Bridge Replace)	\$3.00	\$32,122.50	20	+1	6	Repair (After Bridge Replace)	\$3.00	\$32,122.50 20	+0	6	\$96,367.50	\$24,741.06	\$4,288.2
2062 2063	6						6						6					6			
2063	6						6						6					6			
2065	6						6						6					6			
2066	6						6						6					6			
2067	6						6						6					6			
2068 2069	6						6 6						6 6					6			
2069	5						5						5					5			
2071	5						5						5					5			
2072	5						5						5					5			
2073	5						5						5					5			
2074 2075	5						5 5						5 5					5			
2075	5						5						5					5			
2077	5						5						5					5			
2078	5						5						5					5			
2079	5						5						5					5			
2080	5						5						5					5	40.000	4. 2.2	<b>4</b>
																		Total Cost =	\$2,033,140.10	\$1,610,736.46	\$1,247,221
																	Av	erage Rating =	6.45		
																	AV	End Rating =			
Comments:																					
Comments:																					
omments:																					

		TI UP (#590) / I-40 / N																		
ption 2 - P	Perform	Bridge Rehabilitiation Th	nen Repla	Notes:										Dete	erioration Line Equation					
Bridge Dec	ck Area =	8750 SF			'ear" colun	mn means currer	t bridge is	nearing the end of its expected se	rvice life.				ltem	Slope =	Days Ye	ears Year D				
Widen Dec		10708 SF		2. When super	structure r	replacement is s	elected, de	eck replacement should be selecte	d as well.				Substr	y =		361x 2.77				
	ear Built =	1961						ing during replacement.					Superstr	y =		050x 20.0				
Exp Servi	/ice Life =	75 YR				ipplies to bridge		nt only. e a deck deterioration of 1 point ev	very 20 years Renair (Deck)	should maintain	deck rating f	nr	Deck	y =	-0.000137x -0.	050x 20.0	0			
								a point (i.e., if the rating would dr												
								d be applied to improve the bridge												
Si	ubstructur	<u>e</u>					Supersti	<u>ructure</u>				<u>Deck</u>						<u>Summary</u>		
	Rating	Item	Cost (Per SF)	Cost (Total)	Service	Rating Increase	Rating	g Item	Cost (Per SF) Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total) Servi	ce Life Ratir	-		Present Value at 3%	Present Va
2015 2016	6						8					8								
2017 2018	6	No Rehab/Repair W	ork Can Be I	Done. Not Yet In S	5-Year Pro	ogram.	8 8	No Rehab/Repair W	Vork Can Be Done. Not Yet Ir	5-Year Program		8 8	No Rehab/Repair W	ork Can Be D	Done. Not Yet In 5-Year P	rogram.				
2019	6						8					8								
2020	6	Dahah (Cuhata)	Ć42.07	¢275 007 50			8					8						¢275 007 50	¢244 002 C4	ĆOFO F
2021 2022	7	Rehab (Substr)	\$42.97	\$375,987.50	50	) +2	8 8					8					7	\$375,987.50	\$314,883.61	\$250,53
2023	7						8					8					7			
2024	7						8					8					7			
2025 2026	7						8					8					7			
2026	7						7					7					7			
2028	7						7					7					7			
2029	7						7					7					7			
2030	7				-		7					7					7			
2031	6						7					7					6			
2033	6						7					7					6			
2034	6						7					7					6			
2035	6	Poplace (Pridge)	\$171.88	\$1,840,405.10	75	Rating =	7	Panlace (Bridge)		75	Pating = 0	7 8	Panlace (Bridge)			75 Rating	6 = 8 8	\$1,840,405.10	\$989,308.43	\$444,4
2036	8	Replace (Bridge)	\$1/1.88	\$1,04U,4U5.1U	/5	, kaung=	8	Replace (Bridge)		/5	Rating = 8	8	Replace (Bridge)			75 Rating	8	\$1,640,405.10	Ş303,3U8.43	\$444,4
2038	8						8					8					8			
2039	8						8					8					8			
2040 2041	8						8					8					8			
2041	8						8					8					8			
2043	8						8					8					8			
2044	8						8					8					8			
2045 2046	7						8					8					8 7			
2046	7						7					7					7			
2048	7						7					7					7			
2049	7						7					7					7			
2050 2051	7 7						7					7					7			
2052	7						7					7					7			
2053	7						7					7					7			
2054 2055	7						7					7					7			
2055	7	Repair (After Bridge Replace)	\$3.00	\$32,122.50	20	) +1	7	Repair (After Bridge Replace)	\$3.00 \$32,122.50	20	+1	7	Repair (After Bridge Replace)	\$3.00	\$32,122.50	20 +0	7	\$96,367.50	\$28,681.67	\$6,01
2057	7						7	0,,	,,,,			7					7			
2058	7						7					7					7			
2059 2060	7						7					7					7			
2061	7						7					7					7			
2062	7						7					7					7			
2063	7				-		7					7					7			
2064 2065	7				-		7					7					7			
2066	6						6					6					6			
2067	6						6					6					6			
2068	6						6					6					6			
2069 2070	6				-		6					6					6			
2070	6						6					6					6			
2072	6						6					6					6			
2073	6						6					6					6			
2074	6						6					6					5			
2075 2076	6	Repair (After Bridge Replace)	\$3.00	\$32,122.50	20	) +1	6	Repair (After Bridge Replace)	\$3.00 \$32,122.50	20	+1	6	Repair (After Bridge Replace)	\$3.00	\$32,122.50	20 +0		\$96,367.50	\$15,880.34	\$1,55
2077	6			,			6		, ,			6					6	,,	,====	+-,55
2078	6						6					6					6			
2079	6						6					6					6			
2080	0						6					ь					Total Cos	= \$2,409,127.60	\$1,348,754.05	\$702,5
																	Average Rati	ng = 6.80		
omments:																	End Rati			
					-															
							_													

Part   Part		PAINTED	DESERT	TI UP (#590) / I-40 / N	1P 311.5	7																
Application   Control																						
Second Column   Second Colum														Item				Year Drop				
The column   Column															_							
Column   C	<del> </del>									u as well.												
State   Stat																						
Part						5. Repair deck	(after bridge replace) shou	ld provide a de	eck deterioration of 1 point ev						, i							
March   Marc	-										Deck would mai	ntain a "5" at	t that year.									
Process	-					6. For other rep	pair items, the "+" value rat	ing should be a	applied to improve the bridge	rating's value for that year.												
Process			Substructu	ıre				Superstructur	re				Deck							Summary		
The content of the	Π				Cost (Por		Pating			Cost (Par		Pating			Cost (Por			Pating	Minimum			
Second Second		Year	Rating	Item		Cost (Total)	Service Life	Rating	Item		Service Life	_	Rating	Item		Cost (Total)	Service Life	_			Present Value at 3%	Present Value at 7%
March   Control   Contro	,	2015	6		-			8		· ·			8						_			
Second   S	1		6																			
Second Second	2		6	No Rehab/Repair W	ork Can Be	Done. Not Yet In 5	5-Year Program.		No Rehab/Repair W	Vork Can Be Done. Not Yet In	5-Year Program.			No Rehab/Repair W	Vork Can Be D	one. Not Yet In 5-Ye	ear Program	1.				
Secondary   Column			6				, and the second				, ,						ŭ					
Section   Sect			6																			
Second Second	5		5	Repair (Substr)	\$5.00	\$43,750.00	3 +1	8					8						5	\$43,750.00	\$36,639.94	\$29,152.47
Second Second	7		5					8					8									
0 DO DO DO DO DO DO DO DO DO DO DO DO DO			4	Panair (Substr)	\$5.00	\$42.750.00	2 ±1	8					8							\$42.750.00	\$22 520 72	\$22 707 10
1 DO S	.0		5	Repair (Substi)	ىں.دپ	Ç+3,730.00	3 71	8					8							ŷ <del>4</del> 3,730.00	7، الاحرودود	Ç23, 737. 1U
	1	2026	4					7					8						_			
A SEC   Control   Contro	2	2027	5	Repair (Substr)	\$5.00	\$43,750.00	3 +1	7					7						_	\$43,750.00	\$30,685.37	\$19,425.52
			5					7					7						_			
			5	Repair (Substr)	\$5.00	\$43.750.00	3 +1	7					7							\$43.750.00	\$28.081.46	\$15.857.01
	.6		5		φ5.50	÷ .5, . 50.00		7					7						5	Ţ.S,755.00	Ç20,002.70	Ç15,057.01
	.7	2032	4					7					7									
			_	Repair (Substr)	\$5.00	\$43,750.00	3 +1	7					7							\$43,750.00	\$25,698.51	\$12,944.05
1			4					7					-									
	1		8	Replace (Bridge)	\$171.88	\$1,840,405.10	75 Rating = 8	8	Replace (Bridge)		75	Rating = 8	8	Replace (Bridge)			75	Rating = 8		\$1,840,405.10	\$989,308.43	\$444,481.92
	2		8					8					8						8			
State   Stat			8					8					8						8			
Second   S			8					8					8						8			
State   Stat	16		8					8					8						8			
9 204 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	.7		8					8					8						8			
0			8					8					8						8			
1			8 8					8					8						8			
38   248   7   7   7   7   7   7   7   7   7	1		7					7					7						7			
Second   Control   Contr	12		7					7					7						-			
50 200 7 7 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9			7					7					7									
50   50   7   7   7   7   7   7   7   7   7			7					7					7						· '			
8 253 7 Repair (After Bridge Replace) 53.00 532,122.50 20 +1 7 Repair (After Bridge Replace) 53.00 532,122.50 20 +1 7 Repair (After Bridge Replace) 53.00 532,122.50 20 +1 7 Repair (After Bridge Replace) 53.00 532,122.50 20 +1 7 Repair (After Bridge Replace) 53.00 532,122.50 20 +1 7 Repair (After Bridge Replace) 53.00 532,122.50 20 +1 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	6		7					7					7						7			
2			7					7					7						-			
	-		7					7					7						· '			
2 297 7 7 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	10		6					6					7									
3 2988 7	1			Repair (After Bridge Replace)	\$3.00	\$32,122.50	20 +1	7 R	Repair (After Bridge Replace)	\$3.00 \$32,122.50	20	+1		Repair (After Bridge Replace)	\$3.00	\$32,122.50	20	+0		\$96,367.50	\$28,681.67	\$6,014.45
4 2909 7 7 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9								_														
5	.5		7					7					7						· '			
7	15		7					7					7						7			
8	6		7					7					7									
9			7					7					-									
20			7					7					7									
12 2066 6	0		7					7					7									
3	1		6					6					6									
4 2069 6 6 7 2071 6 7 2072 6 8 8 2073 6 9 7 2072 6 8 8 2073 6 9 7 2074 6 7 2075 6 7	2		6					6					6									
2070 6 6 7 2071 6 6 7 2072 6 7 2072 6 7 2073 6 7			6					6					6									
6 2071 6 8 2072 6 8 2073 6 8 2073 6 8 2074 6 8 2074 6 8 2074 6 8 2075 5 5 8 2075 6 2075 6 20	5		6					6					6									
88   2073   6   2074   6   2074   6   2075   5   2076   6   2076   2076   6   2076   20	6	2071	6					6					6									
9 2074 6 5 8 Repair (After Bridge Replace) 5 5 6 8 Repair (After Bridge Replace) 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5			6					6					6									
2075   5   6   Repair (After Bridge Replace)   53.00   532,122.50   20   +1   6   Repair (After Bridge Replace)   53.00   532,122.50   20   +0   6   596,367.50   515,880.34   51,554.25    2077   6   6   7   7   7   7   7   7   7			6					6					6									
2 2077 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	60		5					5					5									
2078	1		6	Repair (After Bridge Replace)	\$3.00	\$32,122.50	20 +1	6 R	Repair (After Bridge Replace)	\$3.00 \$32,122.50	20	+ 1		Repair (After Bridge Replace)	\$3.00	\$32,122.50	20	+0		\$96,367.50	\$15,880.34	\$1,554.25
4 2079 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6			6					6					_									
5 2080 6 6 6 6 Total Cost = \$2,251,890.10 \$1,188,506.45 \$553,226.77	i4		6					-														
Average Rating = 6.30	i5	2080	6					6					6						6			
																			Total Cost =	\$2,251,890.10	\$1,188,506.45	\$553,226.77
	-																	Ave	erage Rating -	6 30		
	(	Comments:																				

#### PAINTED DESERT TI UP (#590) / I-40 / MP 311.57 COST COMPARISON Present Value 2015 Dollars - Fully Loaded Costs OST COMPARISON Present Value 2015 Dollars - Raw Costs Comparison to Replacement AGENCY COST 3% 7% OPTION AGENCY COST 3% 7% Option **Agency Cost** 3% 7% Option 1 (Replace) | \$ 2,033,140.10 | \$1,610,736.46 \$1,247,221.89 2 (Rehab) 84.39% 119.42% 177.52% Option 1 (Replace) \$4,472,908 \$3,543,620 \$2,743,888 Option 2 (Rehab) \$ 2,409,127.60 \$1,348,754.05 135.53% \$2,967,259 \$702,586.96 3 (Repair) 90.29% 225.44% Option 2 (Rehab) \$5,300,081 \$1,545,691 Option 3 (Repair) \$ 2,251,890.10 \$1,188,506.45 Option 3 (Repair) \$4,954,158 \$2,614,714 \$1,217,099 Bridge Ratings Per Option **AVG RATING END RATING** OPTION Option 1 (Replace) 6.45 6.80 6 Option 2 (Rehab) Option 3 (Repair) 6.30 6 **COST COMPARISON RATING COMPARISON** \$2,500,000.00 Option 1 - Replace Bridge Now \$2,000,000.00 Option 2 - Perform Bridge Rehabilitiation Then \$1,500,000.00 ■ Present Value at 7% Replace ■ Present Value at 3% Option 3 - Perform Minimum Repairs Then \$1,000,000.00 ■ AGENCY COST **AGENCY COST** \$500,000.00 Present Value at 3% \$0.00 Present Value at 7% Option 1 (Replace) Option 2 (Rehab) Option 3 (Repair)

WINDOW ROCK TI OP WB (#678)	/ I-40 / MP 357	7.53							
-			Deterioration Slope						
Bridge Deck Area (A225)	1394 SF		Item	Deterioratio	n Line Equation		Year		
Year Built (N27)	1964		item	Slope =	Days	Years	Drop		
Exp Service Life	75 YR		Substr	y =	-0.000433x	-0.158x	6.33		
Total Bridge Length (N49)	34 LF		Superstr	y =	-0.000456x	-0.166x	6.01		
Number of Spans (N45+N46)	1		Deck	y =	-0.000753x	-0.275x	3.64		
Skew Angle (N34)	0 DEG								
Average Elevation	6157 FT								
Max Pier Height	19 FT					Notes:			
Exp Service Life   75 YR	ed only to corr	ect lane and/o							
	idth defici	encies. It is no	t intended for						
**Scour Critical Rating (N113)	N/A		**If scour critical rating is 3	or lower, Option 2 should consider the		adding traff	ic capacity	(i.e. adding ge	eneral purpos
			implementation of scour co	ountermeasures.		lanes).			
Cost Multipliers				L to # Span Multiplier			Skew Mu	ultiplier	
Elevation > 4000ft	6157	1.25		L/ # Span Ratio	Multiplier		Skew	Multiplier	
Pier Height > 30ft	19	1.00		=>100	1.00		<30	1.00	
Length to # span ratio	34.00	1.25		=>60	1.10		=>30	1.10	
Skew > 30degrees	0.00	1.00		<60	1.25				
roject Cost Multiplier	All Options	2.20							
Adjusted Bridge Replace Cost			<b>Elevation Multiplier</b>			Pier H Multi	iplier		
Pace Pridge Ponlacement Cost /Por CT\	¢12F 00		Elev	Multiplier		Pier H	Multiplie	er	
base bridge kepiacement cost (Per SF)	\$125.00		<4000	1.00		<30	1.00		
Bridge Replacement Cost w/ Multipliers	Ć10F 34		=>4000	1.25		=>30	1.10		
Bridge Deck Area (A225)  Year Built (N27)  1964  Exp Service Life  75 YR  Total Bridge Length (N49)  Number of Spans (N45+N46)  Skew Angle (N34)  Average Elevation  Average Elevation  *Amount of Widening for Bridge  Revised Deck Area (Bridge Replace)  **Scour Critical Rating (N113)  **Scour Critical Rating (N113)  **Station > 4000ft  Pier Height > 30ft  Length to # span ratio  Skew > 30degrees  O.00  **Oject Cost Multiplier  dijusted Bridge Replace Cost  **Station > 4000ft  All Options  **Station > 4000ft  Station > 4000ft  All Options  **Station > 4000ft  Station									
					User input cell				
					Only manipulate cell va	lue after consulti	ng with te	am	

Description	Category Yea
Original I-40-5(29) construction - no additional work located for the bridge.	1964
Latest inspection report shows medium longitudinal cracks in deck, with numerous hairline to narrow cracks on the soffit with expo	d rebar
and some minor spalling.	

Replace / Rehab / Repair Inform	nation			
nepraec y nemas y nepan mjern				
BRIDGE DECK				
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Deck)	Full Deck Replacement	\$97.66	25	Rating = 8
Rehab (Deck Concrete Overlay)	Overlay (Concrete)	\$10.00	15	+2
Rehab (Deck Epoxy Overlay)	Overlay (Epoxy)	\$5.00	10	+1
Repair (Deck)	Patch Spalls / Seal Cracks	\$3.00	See Deterioration Slope	+0
Replace (Bridge)	Full Bridge Replacement	\$195.31	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	\$3.00	20	+0
Repair (After Rehab)	Patch Spalls / Seal Cracks	\$3.00	10	+0
SUPERSTRUCTURE - STEEL				<u> </u>
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Supr - Stl)	Full SuperStr Replacement	\$97.66	50	Rating = 8
Rehab (Supr - Stl)	Weld New Structural Components	\$48.83	15	+2
Repair (Supr - Stl)	Weld Repair / Crack Relief	\$5.00	See Deterioration Slope	+1
SUPERSTRUCTURE - CONCRETE				
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Supr - Conc)	Full SuperStr Replacement	\$97.66	50	Rating = 8
Rehab (Supr - Conc)	Replace Structural Component	\$48.83	15	+2
Repair (Supr - Conc)	Patch Spalls / Seal Cracks	\$5.00	See Deterioration Slope	+1
Replace (Bridge)	Full Bridge Replacement	\$195.31	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	\$3.00	20	+1
Repair (After Rehab)	Patch Spalls / Seal Cracks	\$3.00	10	+1
		·		
SUBSTRUCTURE - STRUCTURAL				
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Replace (Substr)	Full SubStr Replacement	\$97.66	75	Rating = 8
Rehab (Substr)	Replace Structural Component	\$48.83	50	+2
Repair (Substr)	Patch Spalls / Seal Cracks	\$5.00	See Deterioration Slope	+1
SUBSTRUCTURE - SCOUR				
ITEM	DESCRIPTION	UNIT COST (Per SF)	LIFE (YRS)	RATING BENEFIT
Rehab (Substr - Scour)	Add scour protection slabs	\$48.83	50	+ 2
Repair (Substr - Scour)	Patch Spalls / Seal Cracks	\$5.00	See Deterioration Slope	+1
Replace (Bridge)	Full Bridge Replacement	\$195.31	75	Rating = 8
Repair (After Bridge Replace)	Patch Spalls / Seal Cracks	\$3.00	20	+1
Repair (After Rehab)	Patch Spalls / Seal Cracks	\$3.00	10	+1

	WINDOW	ROCK T	П OP WB (#678) / I-40 ,	/ MP 35	7.53																
			Bridge Now																		
					Notes:		·				'			Item		terioration Line Equation	Year Drop				
		eck Area = eck Area =							earing the end of its expected ser creplacement should be selected					Substr	Slope =						
	Υ	ear Built =	1964		3. Deck Rehab	does not acco	unt for any ded	k widening	g during replacement.	· · ·				Superstr	y =	-0.000456x -0.166x	6.01	1			
	Exp Ser	vice Life =	75 YR		4. Widened de				only. I deck deterioration of 1 point eve	on, 20 voor				Deck	y =	-0.000753x -0.275x	3.64				
					o. nepair deck	(aitei bridge	repiace) snoul	u provide a	rueck deterioration of 1 point eve	cry 20 years.											
		Substructur	re					Superstruc	ture				Deck						Summary		
Ī			-	Cost (Per			Rating	,		Cost (Per		Rating			Cost (Per		Rating	Minimum	Total Cost Per Year		
	Year	Rating	Item	SF)	Cost (Total)	Service Life	Increase	Rating	Item	SF) Cost (1	Total) Service Li	ie Increase		g Item	SF)	Cost (Total) Service Life	Increase	Rating	(2015 \$ raw costs)	Present Value at 3%	Present Value at 7%
0	2015	6						4					4								
2	2016 2017	6						4					4 4								
3	2017	6	No Rehab/Repair W	ork Can Be I	Done. Not Yet In S	5-Year Progran	m.	4 4	No Rehab/Repair W	ork Can Be Done. Not	Yet In 5-Year Progr	am.	4	No Rehab/Repair V	Work Can Be I	Done. Not Yet In 5-Year Progra	am.				
4	2019	6						4					4								
5 6	2020 2021	6 8	Replace (Bridge)	\$195.31	\$298,824.30	75	Rating = 8	4 8	Replace (Bridge)		75	Rating = 8	8 8	Replace (Bridge)		75	Rating = 8	8	\$298,824.30	\$250,260.65	\$199,119.25
6 7	2022	8	neplace (Bridge)	ψ133.31	\$230,02 H30	,,,	nating 0	8	nepiace (Singe)		.5	naung (	8	neproce (Bridge)		,,,	nating 0	8	\$250,02 H.50	Ψ230,200.03	Ģ133,113.E3
8 9	2023 2024	8						8					8					8			
10	2024	8						8					8					8			
11	2026	8						8					8					8			
12 13	2027 2028	8 8						8 8					8					8			
14	2029	8						8					8					8			
15	2030	8						8					8					8			
16 17	2031 2032	7						7					7					7			
18	2033	7						7					7					7			
19 20	2034 2035	7						7					7 7					7			
21	2036	7						7					7					7			
22 23	2037	7 7						7					7					7			
24	2038 2039	7						7					7					7			
25	2040	6						6					6					6			
26 27	2041 2042	7 7	Repair (After Bridge Replace)	\$3.00	\$4,590.00	20	+1	7	Repair (After Bridge Replace)	\$3.00 \$4,59	0.00 20	+1	7	Repair (After Bridge Replace)	\$3.00	\$4,590.00 20	+0	7	\$13,770.00	\$6,385.08	\$2,371.13
28	2043	7						7					7					7			
29 30	2044 2045	7						7					7					7			
31	2046	7						7					7					7			
32	2047	7						7					7					7			
33 34	2048 2049	7						7					7 7					7			
35	2050	7						7					7					7			
36 37	2051 2052	6						6					6					6			
38	2053	6						6					6					6			
39	2054	6						6					6					6			
40 41	2055 2056	6						6					6					6			
42	2057	6						6					6					6			
43 44	2058 2059	6						6					6					6			
45	2060	5						5					5					5			
46 47	2061 2062	6	Repair (After Bridge Replace)	\$3.00	\$4,590.00	20	+1	6	Repair (After Bridge Replace)	\$3.00 \$4,59	0.00 20	+1	6	Repair (After Bridge Replace)	\$3.00	\$4,590.00 20	+0	6	\$13,770.00	\$3,535.26	\$612.75
48	2063	6						6					6					6			
49	2064 2065	6						6					6					6			
50 51	2065	6						6					6					6			
52	2067	6						6					6					6			
53 54	2068 2069	6						6					6					6			
55	2070	5						5					5					5			
56 57	2071 2072	5						5					5 5					5			
58	2073	5						5					5					5			
59 60	2074	5						5					5 5					5 5			
61	2075 2076	5						5					5					5			
62	2077	5						5					5					5			
63 64	2078 2079	5 5						5 5					5					5			
65	2080	5						5					5					5			
																		Total Cost =	\$326,364.30	\$260,180.99	\$202,103.13
																	A	erage Rating =	6.45		
	Comments:																	End Rating =			

JUIOII Z - F	erform Brid	ge Rehabilitiation T																				
Bridge De	ck Area –	1394 SF		Notes:	aar" column	noans curront L	oridge is s	earing the end of its expected sen	ice life					ltem	Dete Slope =	rioration Line Eq Days	quation Years	Year Drop				
Widen De		1530 SF						ck replacement should be selected						Substr	у =	-0.000433x	-0.158x	6.33				
	ar Built =	1964						ng during replacement.	us wein					Superstr	y =	-0.000456x	-0.166x	6.01				
Exp Serv		75 YR		4. Widened de								-		Deck	y =	-0.000753x	-0.275x	3.64				
_AP 3CIV	,0 =0							a deck deterioration of 1 point eve	ry 20 years.	Repair (Deck) sh	ould maintain	deck rating for			y -	2.300,334	5.2750	5.54	1			
				life of repair	r, if the rating	would otherw	ise drop a	point (i.e., if the rating would dro	p from a "5"	to a "4", Repair [			/ear.)									
				6. For other rep	air items, the	"+" value ratir	ng should b	be applied to improve the bridge i	ating's valu	e for that year.												
Si	<u>ubstructure</u>						Superstru	<u>icture</u>				Deck								Summary		
Year	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Rating	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase Ra	ting	Item	Cost (Per SF)	Cost (Total)	Service Life	Rating Increase	Minimum Rating	Total Cost Per Year (2015 \$ raw costs)	Present Value at 3%	Present Val
2015	6		37)			ilicrease	4		31)				4		31)			increase	Raung	(2013 \$ Taw Costs)		
2016	6						4						4									
2017 2018	6	No Rehab/Repair \	Vork Can Be D	one. Not Yet In 5	-Year Program	n.	4	No Rehab/Repair W	ork Can Be [	Done. Not Yet In !	5-Year Program		4	No Rehab/Repair Wo	ork Can Be D	one. Not Yet In 5	5-Year Program	1.				
2019 2020	6						4						4									
2021	5						6	Rehab (Supr - Conc)	\$48.83	\$68,065.54	15			eck Concrete Overlay)	\$10.00	\$13,940.00	15	+2	5	\$82,005.54	\$68,678.34	\$54,643
2022 2023	5						6						6						5			
2023	5						6						6						5			
2025	5						6						6						5			
2026 2027	5 4						6						6 6						5			
2028	5	Repair (Substr)	\$5.00	\$6,970.00	6	+1	6						6						5	\$6,970.00	\$4,746.23	\$2,892
2029	5						5						5						5			
2030 2031	5						5						5						5			
2032	5						5						5						5			
2033 2034	5						5						5						5 4			
2034	5	Repair (Substr)	\$5.00	\$6,970.00	6	+ 1	5						5						5	\$6,970.00	\$3,859.12	\$1,801
2036	5						4	Dana's (African Lab	62.02	64.400.00	40		4	Danaia (Dani)	63.00	Ć4 402 00			4	£0.364.60	A. 200.41	4
2037 2038	5 5						5 5	Repair (After Rehab)	\$3.00	\$4,182.00	10	+1	5 F 5	Repair (Deck)	\$3.00	\$4,182.00	4	+0	5 5	\$8,364.00	\$4,365.11	\$1,887
2039	8	Replace (Bridge)	\$195.31	\$298,824.30	75	Rating = 8	8	Replace (Bridge)			75	Rating = 8	8 Re	eplace (Bridge)			75	Rating = 8	8	\$298,824.30	\$147,001.75	\$58,912
2040 2041	8						8						8						8			
2042	8						8						8						8			
2043 2044	8						8						8						8			
2044	8						8						8						8			
2046	8						8						8						8			
2047 2048	8						8						8						8			
2049	7						7						7						7			
2050	7						7						7						7			
2051 2052	7 7						7						7						7			
2053	7						7						7						7			
2054 2055	7						7						7						7			
2055	7						7						, 7						7			
2057	7						7						7						7			
2058 2059	6 7 Rena	ir (After Bridge Replace)	\$3.00	\$4,590.00	20	+1	6 7	Repair (After Bridge Replace)	\$3.00	\$4,590.00	20	+1	b 7 Renair//	After Bridge Replace)	\$3.00	\$4,590.00	20	+0	6 7	\$13,770.00	\$3,750.56	\$701.5
2060	7 Nepa	(Auto. Siluge Nepiace)	Ç5.00	Ç 19550.00	20		7		<i>\$5.00</i>	Ç +,550.00	20		7 (F	bridge neplace/	Ç3.00	y 1,550.00	2.0	. 5	7	Ş13,770.00	Ç5,750.50	Ş/U1.
2061	7						7						7						7			
2062 2063	7						7 7						7						7			
2064	7						7						7						7			
2065 2066	7						7 7						7 7						7			
2066	7						7						7						7			
2068	7						7						7						7			
2069 2070	6						6						6						6			
2071	6						6						6						6			
2072 2073	6						6						6						6			
2073	6						6						6						6			
2075	6						6						6						6			
2076 2077	6						6 6						6						6			
2078	5	ir (After Pridge Panlau)	¢2.00	\$4 500 00	20	. 1	5	Panair (After Prides Paulan)	¢2.00	\$4 500 00	20	+1	5 6 Pozzis (1	After Bridge Boolean	¢2.00	\$4 500 00	20		5	(12 770 00	¢2.076.50	Ć104
2079 2080	6 Repa	ir (After Bridge Replace)	\$3.00	\$4,590.00	20	+1	6 6	Repair (After Bridge Replace)	\$3.00	\$4,590.00	20		6 Repair (A 6	After Bridge Replace)	\$3.00	\$4,590.00	20	+0	6	\$13,770.00	\$2,076.59	\$181.
																			Total Cost =	\$430,673.84	\$234,477.71	\$121,02
																		Av	erage Rating =			
																			End Rating =	6		
ments:																						

		KUCK	TI OP WB (#678) / I-40	/ MP 35	7.53																	
	tion 3 - F		n Minimum Repairs Then F																			
				<u>.</u>	Notes:									Item		rioration Line Eq	1	Year Drop				
	Bridge De			1				s nearing the end of its expected ser							Slope =	Days	Years					
	Widen De							deck replacement should be selected	d as well.					Substr	y =	-0.000433x -0.000456x	-0.158x -0.166x	6.33 6.01				
		ear Built = vice Life =	•	1		does not account for any one eck area applies to bridge								Superstr Deck	y = y =	-0.000456x -0.000753x	-0.166X -0.275x	3.64				
	Exp Serv	vice Life	75 111					de a deck deterioration of 1 point ev	ery 20 years.	Repair (Deck) sh	nould maintain	deck rating fo	or	Dean	,	0.000733X	0.273X	5.01				
								p a point (i.e., if the rating would dro			Deck would ma	intain a "5" at	that year.									
					6. For other re	pair items, the "+" value ra	ating shoul	ld be applied to improve the bridge	rating's value	for that year.												
	S	Substructu	ure				Superst	<u>tructure</u>					<u>Deck</u>							Summary		
				Cost (Per		Rating			Cost (Per			Rating			Cost (Per			Rating	Minimum	Total Cost Per Year		
Y	Year	Rating	Item	SF)	Cost (Total)	Service Life Increase	Rating	ng Item	SF)	Cost (Total)	Service Life	Increase	Rating	Item	SF)	Cost (Total)	Service Life	Increase	Rating	(2015 \$ raw costs)	Present Value at 3%	Present Value at
2	2015	6					4						4						-			
	2016	6					4						4									
	2017	6	No Rehab/Repair W	/ork Can Be	Done. Not Yet In	5-Year Program.	4	No Rehab/Repair W	ork Can Be D	one. Not Yet In	5-Year Program		4	No Rehab/Repair W	ork Can Be D	one. Not Yet In 5	-Year Program					
	2018 2019	6				, and the second	4 4				, and the second		4									
	2020	6					4						4									
2	2021	5					5	Repair (Supr - Conc)	\$5.00	\$6,970.00	6	+1	4	Repair (Deck)	\$3.00	\$4,182.00	4	+0	4	\$11,152.00	\$9,339.62	\$7,431.05
	2022	5					5						4						4			
	2023 2024	5					5						4						4			
	2024	5					5						4	Repair (Deck)	\$3.00	\$4,182.00	4	+0	4	\$4,182.00	\$3,111.80	\$2,125.92
	2026	5					5						4	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		.,			4	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	1.,	. ,
	2027	4			4		4		4	40			4						4	4		
	2028 2029	5	Repair (Substr)	\$5.00	\$6,970.00	6 +1	5	Repair (Supr - Conc)	\$5.00	\$6,970.00	6	+1	4 4	Repair (Deck)	\$3.00	\$4,182.00	4	+0	4	\$13,940.00 \$4,182.00	\$9,492.46 \$2,764.79	\$5,784.60 \$1,621.85
	2030	5					5						4	nepun (beck)	Ş3.00	Ş+,102.00	-		4	Ş4,102.00	32,704.73	Ç1,021.03
	2031	5					5						4						4			
	2032	5					5						4						4			
	2033 2034	5 4					5						4	Repair (Deck)	\$3.00	\$4,182.00	4	+0	4	\$4,182.00	\$2,456.48	\$1,237.30
	2035	5	Repair (Substr)	\$5.00	\$6,970.00	6 +1	5	Repair (Supr - Conc)	\$5.00	\$6,970.00	6	+1	4						4	\$13,940.00	\$7,718.24	\$3,602.36
2	2036	5					5	/					4						4			
	2037	5					5						4	Repair (Deck)	\$3.00	\$4,182.00	4	+0	4	\$4,182.00	\$2,182.55	\$943.93
	2038	5	Replace (Bridge)	\$195.31	\$298,824.30	75 Rating =	5	Replace (Bridge)			75	Rating = 8	4 8	Replace (Bridge)			75	Rating = 8	4	\$298,824.30	\$147,001.75	\$58,912.20
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_	2058 2059	7	Repair (After Bridge Replace)	\$3.00	\$4,590.00	20 +1	- 6 7	Repair (After Bridge Replace)	\$3.00	\$4,590.00	20	+1	6 7	Repair (After Bridge Replace)	\$3.00	\$4,590.00	20	+0	- 6 7	\$13,770.00	\$3,750.56	\$701.53
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#### WINDOW ROCK TI OP WB (#678) / I-40 / MP 357.53 COST COMPARISON Present Value 2015 Dollars - Fully Loaded Costs COST COMPARISON Present Value 2015 Dollars - Raw Costs Comparison to Replacement AGENCY COST 7% OPTION AGENCY COST OPTION 7% Option **Agency Cost** 3% 3% 7% \$202,103.13 75.78% 110.96% 167.00% \$718,001 \$572,398 \$444,627 Option 1 (Replace) 326,364.30 \$260,180.99 2 (Rehab) Option 1 (Replace) Option 2 (Rehab) \$ 430,673.84 \$234,477.71 \$121,020.12 3 (Repair) 85.41% 137.01% 244.85% Option 2 (Rehab) \$947,482 \$515,851 \$266,244 \$840,673 Option 3 (Repair) \$ 382,124.30 \$189,894.87 \$82,542.04 Option 3 (Repair) \$417,769 \$181,592 **Bridge Ratings Per Option** AVG RATING **END RATING** OPTION Option 1 (Replace) 6.45 Option 2 (Rehab) 6.28 6 Option 3 (Repair) 6.03 6 **COST COMPARISON RATING COMPARISON** \$450,000.00 \$400,000.00 Option 1 - Replace Bridge Now \$350,000.00 \$300,000.00 Option 2 - Perform Bridge Rehabilitiation Then ■ Present Value at 7% \$250,000.00 ■ Present Value at 3% \$200,000.00 Option 3 - Perform Minimum Repairs Then **AGENCY COST** \$150,000.00 Replace AGENCY COST \$100,000.00 \$50,000.00 Present Value at 3% \$0.00 Present Value at 7% Option 1 (Replace) Option 2 (Rehab) Option 3 (Repair)

**Appendix C: Crash Modification Factors** 

September 2016

SOLUTION	CONSTRUCTION COST	UNIT	FACTOR	TOTAL CONSTRUCTION COST	DESCRIPTION	CMF FOR CORRIDOR PROFILE STUDIES	CMF NOTES
REHABILITATION							
Rehabilitate Pavement (AC)	\$276,500	Mile	2.20	\$610,000	Mill and replace 1"-3" AC pvmt; accounts for 38' width; for one direction of travel on two lane roadway; includes pavement, striping, delineators, RPMs, rumble strips	0.70	Combination of rehabilitate pavement (0.92), striping, delineators, RPMs (0.77 for combination), and rumble strips (0.89) = 0.70
Rehabilitate Bridge	\$65	SF	2.20	\$140	Based on deck area; bridge only - no other costs included	0.95	Assumed - should have a minor effect on crashes at the bridge
GEOMETRIC IMPROVEMENT							
Re-profile Roadway	\$974,500	Mile	2.20	\$2,140,000	Includes excavation of approximately 3", pavement replacement (AC), striping, delineators, RPMs, rumble strips, for one direction of travel of 2-lane roadway (38' width)	0.70	Assumed - this is similar to rehab pavement. This solution is intended to address vertical clearance at bridge, not profile issue.
Realign Roadway	\$2,960,000	Mile	2.20	\$6,510,000	All costs per direction except bridges; applicable to areas with small or moderate fills and cuts, minimal retaining walls	0.50	Based on CalTrans and NC DOT
Improve Skid Resistance	\$675,000	Mile	2.20	\$1,490,000	Average cost of pvmt replacement and variable depth paving to increase super-elevation; for one direction of travel on two lane roadway; includes pavement, striping, delineators, RPMs, rumble strips	0.66	Combination of avg of 5 values from clearinghouse (0.77) and calculated value from HSM (0.87) for skid resistance; striping, delineators, RPMs (0.77 for combination), and rumble strips (0.89) = 0.66
INFRASTRUCTURE IMPROVEI	MENT						
INFRASTRUCTURE IMPROVE	VICINI						
Reconstruct to Urban Section	\$1,000,000	Mile	2.20	\$2,200,000	Includes widening by 16' total (AC = 12'+2'+2') to provide median, curb & gutter along both side of roadway, single curb for median, striping (doesn't include widening for additional travel lane).	0.88	From HSM
Construct Auxiliary Lanes (AC)	\$914,000	Mile	2.20	\$2,011,000	For addition of aux lane (AC) in one direction of travel; includes all costs except bridges; for generally at-grade facility with minimal walls and no major drainage improvements	0.78	Average of 4 values from clearinghouse
Construct Climbing Lane (High)	\$3,000,000	Mile	2.20	\$6,600,000	All costs except bridges; applicable to areas with large fills and cuts, retaining walls, rock blasting, steep slopes on both sides of road	0.75	From HSM

SOLUTION	CONSTRUCTION COST	UNIT	FACTOR	TOTAL CONSTRUCTION COST	DESCRIPTION	CMF FOR CORRIDOR PROFILE STUDIES	CMF NOTES
Construct Climbing Lane (Medium)	\$2,250,000	Mile	2.20	\$4,950,000	All costs except bridges; applicable to areas with medium or large fills and cuts, retaining walls, rock blasting, steep slopes on one side of road	0.75	From HSM
Construct Climbing Lane (Low)	\$1,500,000	Mile	2.20	\$3,300,000	All costs except bridges; applicable to areas with small or moderate fills and cuts, minimal retaining walls	0.75	From HSM
Construct Passing Lane	\$1,500,000	Mile	2.20	\$3,300,000	All costs except bridges; applicable to areas with small or moderate fills and cuts, minimal retaining walls	0.63	Average of 3 values from clearinghouse
Construct Reversible Lane (Low)	\$2,400,000	Lane- Mile	2.20	\$5,280,000	All costs except bridges; applicable to areas with small or moderate fills and cuts, minimal retaining walls	0.73 for uphill and 0.88 for downhill	Based on proposed conditions on I-17 with 2 reversible lanes and a conc barrier
Construct Reversible Lane (High)	\$4,800,000	Lane- Mile	2.20	\$10,560,000	All costs except bridges; applicable to areas with large fills and cuts, retaining walls, rock blasting, mountainous terrain	0.73 for uphill and 0.88 for downhill	Based on proposed conditions on I-17 with 2 reversible lanes and a conc barrier
Construct Entry/Exit Ramp	\$730,000	Each	2.20	\$1,610,000	Cost per ramp; includes pavement, striping, signing, RPMs, lighting, typical earthwork & drainage; does not include any major structures or improvements on crossroad	1.09	Average of 16 values on clearinghouse; for adding a ramp not reconstructing
Construct Turn Lanes	\$170,000	Each	2.20	\$374,000	Includes 14' roadway widening (AC) for one additional turn lane (250' long) on one leg of an intersection; includes AC pavement, curb & gutter, sidewalk, ramps, striping, and minor signal modifications	0.81	Average of 7 values from HSM
Modify Entry/Exit Ramp	\$445,000	Each	2.20	\$979,000	Cost per ramp; includes pavement, striping, signing, RPMs, lighting, minor earthwork, & drainage; For converting existing ramp to parallel-type configuration	0.21	Average of 4 values from clearinghouse (for exit ramps) and equation from HSM (for entrance ramp)
Widen & Modify Entry/Exit Ramp	\$619,000	Each	2.20	\$1,361,800	Cost per ramp; includes pavement, striping, signing, RPMs, lighting, minor earthwork, & drainage; For converting 1-lane ramp to 2-lane ramp and converting to parallel-type ramp	0.21	Will be same as "Modify Ramp"
Replace Pavement (AC)(with overexcavation)	\$1,446,500	Mile	2.20	\$3,180,000	Accounts for 38' width; for one direction of travel on two lane roadway; includes pavement, overexcavation, striping, delineators, RPMs, rumble strips	0.70	Same as rehab
Replace Pavement (PCCP)(with overexcavation)	\$1,736,500	Mile	2.20	\$3,820,000	Accounts for 38' width; for one direction of travel on two lane roadway; includes pavement, overexcavation, striping, delineators, RPMs, rumble strips	0.70	Same as rehab
Replace Bridge	\$125	SF	2.20	\$280	Based on deck area; bridge only - no other costs included	0.95	Assumed - should have a minor effect on crashes at the bridge

SOLUTION	CONSTRUCTION COST	UNIT	FACTOR	TOTAL CONSTRUCTION COST	DESCRIPTION	CMF FOR CORRIDOR PROFILE STUDIES	CMF NOTES
Widen Bridge	\$175	SF	2.20	\$390	Based on deck area; bridge only - no other costs included	0.90	Assumed - should have a minor effect on crashes at the bridge
Install Pedestrian Bridge	\$135	SF	2.20	\$300	Includes cost to construct bridge based on linear feet of the bridge. This costs includes and assumes ramps and sidewalks leading to the structure.	0.10 (ped only)	Assumed
Implement Automated Bridge De-icing	\$115	SF	2.20	\$250	Includes cost to replace bridge deck and install system	0.72 (snow/ice)	Average of 3 values on clearinghouse for snow/ice
Install Wildlife Crossing Under Roadway	\$650,000	Each	2.20	\$1,430,000	Includes cost of structure for wildlife crossing under roadway	0.25 (wildlife)	Assumed
Install Wildlife Crossing Over Roadway	\$1,140,000	Each	2.20	\$2,508,000	Includes cost of structure for wildlife crossing over roadway	0.25 (wildlife)	Assumed
Construct Drainage Structure - Minor	\$280,000	Each	2.20	\$616,000	Includes 3-36" pipes and roadway reconstruction (approx. 1,000 ft) to install pipes	0.70	Same as pavement rehab
Construct Drainage Structure - Intermediate	\$540,000	Each	2.20	\$1,188,000	Includes 5 barrel 8'x6' RCBC and roadway reconstruction (approx. 1,000 ft) to install RCBC	0.70	Same as pavement rehab
Construct Drainage Structure - Major	\$8,000	LF	2.20	\$17,600	Includes bridge that is 40' wide and reconstruction of approx. 500' on each approach	0.70	Same as pavement rehab
Install Center Turn Lane	\$450,000	Mile	2.20	\$990,000	Assumes widening (AC) of undivided facility to provide directional left- turn lane or two-way left-turn lane with associated transitions, signage and markings and standard shoulders; includes all costs except bridges; for generally at-grade facility with minimal walls and no major drainage improvements	0.86	Average of 2 values from CMF Clearinghouse
OPERATIONAL IMPROVEMEN	T						
Implement Variable Speed Limits (Wireless, Overhead)	\$718,900	Mile	2.20	\$1,580,000	Includes 2 signs per mile (foundations and structures), wireless communication, detectors	0.92	From 1 value from clearinghouse
Implement Variable Speed Limits (Wireless, Ground- mount)	\$169,700	Mile	2.20	\$373,300	Includes 2 signs per mile (foundations and posts), wireless communication, detectors	0.92	From 1 value from clearinghouse
Implement Variable Speed Limits (Wireless, Solar, Overhead)	\$502,300	Mile	2.20	\$1,110,000	Includes 2 signs per mile (foundations and structures), wireless communication, detectors, solar power	0.92	From 1 value from clearinghouse
Implement Variable Speed Limits (Wireless, Solar, Ground-mount)	\$88,400	Mile	2.20	\$194,500	Includes 2 signs per mile (foundations and posts), wireless communication, detectors, solar power	0.92	From 1 value from clearinghouse
Implement Ramp Metering (Low)	\$25,000	Each	2.20	\$55,000	For each entry ramp location; urban area with existing ITS backbone infrastructure; includes signals, poles, timer, pull boxes, etc	0.64	From 1 value from clearinghouse

SOLUTION	CONSTRUCTION COST	UNIT	FACTOR	TOTAL CONSTRUCTION COST	DESCRIPTION	CMF FOR CORRIDOR PROFILE STUDIES	CMF NOTES
Implement Ramp Metering (High)	\$150,000	Mile	2.20	\$330,000	Area without existing ITS backbone infrastructure; in addition to ramp meters, also includes conduit, fiber optic lines, and power	0.64	From 1 value from clearinghouse
Implement Shoulder Running (ATM components only)	\$718,900	Mile	2.20	\$1,581,600	Includes overhead signs, wireless communication, etc, but does not include shoulder widening	0.78	Combination of adding climbing lane & reducing shldr when active, and increasing shldr when not active
Implement Shoulder Running (ATM and shoulder widening)	\$1,920,000	Mile	2.20	\$4,224,000	Includes overhead signs, communication backbone, etc, and shoulder widening with pavement striping, striping, etc to widen by 10'	0.78	Combination of adding climbing lane & reducing shldr when active, and increasing shldr when not active
Implement Shoulder Running (ATM and shoulder widening in mountainous terrain)	\$3,120,000	Mile	2.20	\$6,864,000	Includes overhead signs, communication backbone, etc, and shoulder widening in mountainous terrain with pavement striping, striping, etc to widen by 10'	0.78	Combination of adding climbing lane & reducing shldr when active, and increasing shldr when not active
Implement Signal Coordination	\$140,000	Mile	2.20	\$308,000	Includes conduit, conductors, and controllers for 4 intersections that span a total of approximately 2 miles.	0.90	Assumed
Implement Left-turn Phasing	\$7,500	Mile	2.20	\$16,500	Includes four new signal heads (two in each direction) and associated conductors for one intersection	0.88 (protected) 0.98 (perm/prot or prot/perm)	From HSM; CMF = 0.94 for each protected approach and 0.99 for each perm/prot or prot/perm approach. CMFs of different approaches should be multiplied together
ROADSIDE DESIGN							
Install Guardrail	\$130,000	Mile	2.20	\$286,000	One side of road	0.62 (ROR)	0.62 is avg of 2 values from clearinghouse
Install Cable Barrier	\$80,000	Mile	2.20	\$176,000		0.81	0.81 is average of 5 values from clearinghouse
Widen Shoulder (AC)	\$256,000	Mile	2.20	\$563,000	Assumes 10' of existing shoulder (combined left and right), includes widening shoulder by a total of 4'; new pavement for 4' width and mill and replace existing 10' width; includes pavement, minor earthwork, striping edge lines, RPMs, high-visibility delineators, and rumble strips	0.68 (1-4ft) 0.64 (4+ft)	0.86 is avg of 5 values from clearing house for widening shoulder 1-4'. 0.76 is calculated from HSM for widening shoulder >= 4'. Include striping, delineators, RPMs (0.77 combined CMF), and rumble strips (0.89). (Cost needs to be updated if dimension of existing and widened shoulder differ from Description.)
Rehabilitate Shoulder (AC)	\$113,000	Mile	2.20	\$249,000	One direction of travel (14' total shldr width-4' left and 10' right); includes paving (mill and replace), striping, high-visibility delineators, RPMs, and rumble strips for both shoulders	0.72	0.98 is average of 34 values on clearinghouse for shldr rehab/replace; include striping, delineators, RPMs (0.77 combined CMF), and rumble strips (0.89). (Cost needs to be updated if

SOLUTION	CONSTRUCTION	UNIT	FACTOR	TOTAL CONSTRUCTION COST	DESCRIPTION	CMF FOR CORRIDOR PROFILE STUDIES	CMF NOTES
							dimension of existing shoulder differs from Description.)
Replace Shoulder (AC)	\$364,000	Mile	2.20	\$801,000	One direction of travel (14' total shldr width-4' left and 10' right); includes paving (full reconstruction), striping, high-visibility delineators, RPMs, and rumble strips for both shoulders	0.72	0.98 is average of 34 values on clearinghouse for shldr rehab/replace; include striping, delineators, RPMs (0.77 combined CMF), and rumble strips (0.89). (Cost needs to be updated if dimension of existing shoulder differs from Description.)
Install Rumble Strip	\$5,500	Mile	2.20	\$12,000	Both edges - one direction of travel; includes only rumble strip; no shoulder rehab or paving or striping	0.89	Average of 75 values on clearinghouse and consistent with HSM
Install Safety Edge	\$80,000	Mile	2.20	\$176,000		0.87	Average of 12 values on clearinghouse
Install Wildlife Fencing	\$340,000	Mile	2.20	\$748,000	Fencing only plus jump outs for 1 mile (both directions)	0.50 (wildlife)	Assumed
Remove Tree/Vegetation	\$200,000	Mile	2.20	\$440,000		0.62	CMF Clearinghouse for removal of fixed object
Install Centerline Rumble Strip	\$2,800	Mile	2.20	\$6,000	Includes rumble strip only; no pavement rehab or striping	0.85	From HSM
Install Access Barrier Fence	\$15	LF	2.20	\$33	8' fencing along one side of roadway	0.10 (ped only)	Assumed
Install Rock-Fall Mitigation – Wire Mesh	\$1,320,000	Mile	2.20	\$2,904,000	Includes wire mesh and rock stabilization (one direction only)	0.75 (debris)	Assumed
Install Rock-Fall Mitigation – Containment Fence & Barrier	\$2,112,000	Mile	2.20	\$4,646,000	Includes containment fencing, concrete barrier, and rock stabilization (one direction only)	0.75 (debris)	Assumed
Install Raised Concrete Barrier in Median	\$650,000	Mile	2.20	\$1,430,000	Includes concrete barrier with associated striping and reflective markings; excludes lighting in barrier (one direction)	0.90 (Cross- median and head on crashes eliminated completely)	All cross median and head-on fatal or incapacitating injury crashes are eliminated completely; all remaining crashes have 0.90 applied
INTERSECTION IMPROVEMENT	IT.						
Construct Traffic Signal	\$150,000	Each	2.20	\$330,000	4-legged intersection; includes poles, foundations, conduit, controller, heads, luminaires, mast arms, etc.	0.95	From HSM
Improve Signal Visibility	\$35,000	Each	2.20	\$77,000	4-legged intersection; signal head size upgrade, installation of new back- plates, and installation of additional signal heads on new poles.	0.85	Average of 7 values on clearinghouse

SOLUTION	CONSTRUCTION	UNIT	FACTOR	TOTAL CONSTRUCTION COST	DESCRIPTION	CMF FOR CORRIDOR PROFILE STUDIES	CMF NOTES
Install Raised Median	\$360,000	Mile	2.20	\$792,000	Includes removal of 14' wide pavement and construction of curb & gutter; does not include cost to widen roadway to accommodate the median; if the roadway needs to be widened, include cost from New General Purpose Lane	0.83	Average from HSM
Install Transverse Rumble Strip	\$3,000	Each	2.20	\$7,000	Includes pedestrian markings and rumble strips only across a 30' wide travel-way; no pavement rehab or other striping	0.95	Average of 17 values on clearinghouse
Construct Single-Lane Roundabout	\$1,500,000	Each	2.20	\$3,300,000	Removal of signal at 4-legged intersection; realignment of each leg for approx. 800 feet including paving, curbs, sidewalk, striping, lighting, signing	0.22	From HSM
Construct Double-Lane Roundabout	\$1,800,000	Each	2.20	\$3,960,000	Removal of signal at 4-legged intersection; realignment of each leg for approx. 800 feet including paving, curbs, sidewalk, striping, lighting, signing	0.40	From HSM
ROADWAY DELINEATION							
Install High-Visibility Edge Line Striping	\$10,800	Mile	2.20	\$23,800	2 edge lines and lane line - one direction of travel		Avg of 3 values from clearinghouse. Assumes package of striping, delineators, and RPMs (if implemented separately, CMF will be higher)
Install High-Visibility Delineators	\$6,500	Mile	2.20	\$14,300	Both edges - one direction of travel	0.77	Avg of 3 values from clearinghouse. Assumes package of striping, delineators, and RPMs (if implemented separately, CMF will be higher)
Install Raised Pavement Markers	\$2,000	Mile	2.20	\$4,400	Both edges - one direction of travel		Avg of 3 values from clearinghouse. Assumes package of striping, delineators, and RPMs (if implemented separately, CMF will be higher)
Install In-Lane Route Markings	\$6,000	Each	2.20	\$13,200	Installation of a series of three in-lane route markings in one lane	0.95	Assumed
IMPROVED VISIBILITY							
Cut Side Slopes	\$80	Lin Ft	2.20	\$200	For small grading to correct sight distance issues; not major grading	0.85	Intent of this solution is to improve sight distance. Most CMF's are associated with vehicles traveling on slope. Recommended CMF is based on FDOT and NCDOT but is more conservative.
Install Lighting (connect to existing power)	\$270,000	Mile	2.20	\$594,000	One side of road only; offset lighting, not high-mast; does not include power supply; includes poles, luminaire, pull boxes, conduit, conductor	0.75 (night)	Average of 3 values on clearinghouse & consistent with HSM

SOLUTION	CONSTRUCTION	UNIT	FACTOR	TOTAL CONSTRUCTION COST	DESCRIPTION	CMF FOR CORRIDOR PROFILE STUDIES	CMF NOTES
Install Lighting (solar powered LED)	\$10,000	Pole	2.20	\$22,000	Offset lighting, not high-mast; solar power LED; includes poles, luminaire, solar panel	0.75 (night)	Average of 3 values on clearinghouse & consistent with HSM
DRIVER INFORMATION/WARN	IING						
Install Dynamic Message Sign (DMS)	\$250,000	Each	2.20	\$550,000	Includes sign, overhead structure, and foundations; wireless communication; does not include power supply	1.00	Not expected to reduce crashes
Install Dynamic Weather Warning Beacons	\$40,000	Each	2.20	\$88,000	Assumes solar operation and wireless communication or connection to existing power and communication; ground mounted; includes posts, foundations, solar panel, and dynamic sign	0.65 (weather related)	Avg of 3 values from HSM for dynamic/changeable warning signs
Install Speed Feedback Signs	\$25,000	Each	2.20	\$55,000	Assumes solar operation and no communication; ground mounted; includes regulatory sign, posts, foundations, solar panel, and dynamic sign	0.54	From HSM
Install Chevrons	\$18,400	Mile	2.20	\$40,500	On one side of road - includes signs, posts, and foundations	0.79	Average of 11 values on clearinghouse
Install Warning Signs	\$2,500	Each	2.20	\$5,500	Includes 2 signs, posts, and foundations	0.83	Average of 4 clearinghouse values
Install Wildlife Warning System	\$162,000	Each	2.20	\$356,400	Includes wildlife detection system, flashing warning signs (assumes solar power), advance signing, CCTV (solar and wireless), and fencing for approximately 2 miles in each direction	0.50 (wildlife)	Assumed
Install Warning Sign with Beacons	\$15,000	Each	2.20	\$33,000	In both directions; includes warning sign, post, and foundation, and flashing beacons (assumes solar power) at one location	0.75	FHWA Desktop Reference for Installing Flashing Beacons as Advance Warning = 0.75
Install Larger Stop Sign with Beacons	\$10,000	Each	2.20	\$22,000	In one direction; includes large stop sign, post, and foundation, and flashing beacons (assumes solar power) at one location	0.85/0.81	Use 0.85 for adding beacons to an existing sign; 0.81 for installing a larger sign with flashing beacons
DATA COLLECTION							
Install Roadside Weather Information System (RWIS)	\$60,000	Each	2.20	\$132,000	Assumes wireless communication and solar power, or connection to existing power and communications	1.00	Not expected to reduce crashes
Install Closed Circuit Television (CCTV) Camera	\$25,000	Each	2.20	\$55,000	Assumes connection to existing ITS backbone or wireless communication; does not include fiber-optic backbone infrastructure; includes pole, camera, etc	1.00	Not expected to reduce crashes
Install Vehicle Detection Stations	\$15,000	Each	2.20	\$33,000	Assumes wireless communication and solar power, or connection to existing power and communications	1.00	Not expected to reduce crashes
Install Flood Sensors (Activation)	\$15,000	Each	2.20	\$33,000	Sensors with activation cabinet to alert through texting (agency)	1.00	Not expected to reduce crashes

SOLUTION	CONSTRUCTION COST	UNIT	FACTOR	TOTAL CONSTRUCTION COST	DESCRIPTION	CMF FOR CORRIDOR PROFILE STUDIES	CMF NOTES
Install Flood Sensors (Gates)	\$100,000	Each	2.20	\$220,000	Sensors with activation cabinet to alert through texting (agency) and beacons (public) plus gates	1.00	Not expected to reduce crashes
WIDEN CORRIDOR							
Construct New General Purpose Lane (PCCP)	\$1,740,000	Mile	2.20	\$3,830,000	For addition of 1 GP lane (PCCP) in one direction; includes all costs except bridges; for generally at-grade facility with minimal walls and no major drainage improvements	0.90	North Carolina DOT uses 0.90 and Florida DOT uses 0.87
Construct New General Purpose Lane (AC)	\$1,200,000	Mile	2.20	\$2,640,000	For addition of 1 GP lane (AC) in one direction; includes all costs except bridges; for generally at-grade facility with minimal walls and no major drainage improvements	0.90	North Carolina DOT uses 0.90 and Florida DOT uses 0.88
Convert a 2-lane undivided highway to a 5-lane highway	\$1,576,000	Mile	2.20	\$3,467,200	For expanding a 2-lane undivided highway to a 5-lane highway (4 through lanes with TWLTL), includes standard shoulder widths but no curb, gutter, or sidewalks	0.70	Assumed to be slightly lower than converting from a 4-lane to a 5-lane highway
Convert a 4-lane undivided highway to a 5-lane highway	\$1,053,000	Mile	2.20	\$2,316,600	For expanding a 4-lane undivided highway to a 5-lane highway (4 through lanes with TWLTL), includes standard shoulder widths but no curb, gutter, or sidewalk	0.75	From FHWA Desktop Reference for CRFs, CMF Clearinghouse, and SR 87 CPS comparison
Construct 4-lane Divided Highway (Using Existing 2-lane Road for one direction)	\$3,000,000	Mile	2.20	\$6,600,000	In both directions; one direction uses existing 2-lane road; other direction assumes addition of 2 new lanes (AC) with standard shoulders; includes all costs except bridges	0.67	Assumed
Construct 4-lane Divided Highway (No Use of Existing Roads)	\$6,000,000	Mile	2.20	\$13,200,000	In both directions; assumes addition of 2 new lanes (AC) with standard shoulders in each direction; includes all costs except bridges	0.67	Assumed
Construct Bridge over At- Grade Railroad Crossing	\$10,000,000	Each	2.20	\$22,000,000	Assumes bridge width of 4 lanes (AC) with standard shoulders; includes abutments and bridge approaches; assumes vertical clearance of 23'4" + 6'8" superstructure	0.72 (All train-related crashes eliminated)	Removes all train-related crashes at atgrade crossing; all other crashes CMF = 0.72
Construct Underpass at At- Grade Railroad Crossing	\$15,000,000	Each	2.20	\$33,000,000	Assumes underpass width of 4 lanes (AC) with standard shoulders; includes railroad bridge with abutments and underpass approaches; assumes vertical clearance of 16'6" + 6'6" superstructure	0.72 (All train-related crashes eliminated)	Removes all train-related crashes at atgrade crossing; all other crashes CMF = 0.72
Construct High-Occupancy Vehicle (HOV) Lane	\$900,000	Mile	2.20	\$1,980,000	For addition of 1 HOV lane (AC) in one direction with associated signage and markings; includes all costs except bridges; for generally at-grade facility with minimal walls and no major drainage improvements	0.95	Similar to general purpose lane
ALTERNATE ROUTE							

SOLUTION	CONSTRUCTION COST	UNIT	FACTOR	TOTAL CONSTRUCTION COST	DESCRIPTION	CMF FOR CORRIDOR PROFILE STUDIES	CMF NOTES
Construct Frontage Roads	\$2,400,000	Mile	2.20	\$5,280,000	For 2-lane AC frontage road; includes all costs except bridges; for generally at-grade facility with minimal walls	0.90	Assumed - similar to new general purpose lane
Construct 2-lane Undivided Highway	\$3,000,000	Mile	2.20		In both directions; assumes addition of 2 new lanes (AC) with standard shoulders in each direction; includes all costs except bridges	0.90	Assuming new alignment for a bypass

**Appendix D: Performance Area Risk Factors** 

September 2016

Negleige Person #0

### **Pavement Performance Area**

- Mainline Daily Traffic Volume
- Mainline Daily Truck Volume
- Elevation
- Interrupted Flow

### Elevation

Variance above 4000' divided by 1000; (Elev-4000)/1000

Score Condition 0 < 4000' 0-5 4000'- 9000' 5 > 9000'

### Mainline Daily Traffic Volume

Exponential equation; score =  $5-(5*e^{(ADT*-0.000039)})$ 

Score Condition
0 < 6,000
0-5 6,000 - 160,000
5 > 160,000

### Mainline Daily Truck Volume

Exponential equation; score =  $5-(5*e^{(ADT*-0.00025)})$ 

Score Condition 0 <900 0-5 900-25,000 5 >25,000

### Interrupted Flow

Score Condition

0 Not interrupted flow

5 Interrupted Flow

### **Bridge Performance Area**

• Mainline Daily Traffic Volume

Scour Critical RatingCarries Mainline Traffic

Detour Length

Elevation

Vertical Clearance

### Mainline Daily Traffic Volume

Exponential equation; score =  $5-(5*e^{(ADT*-0.000039)})$ 

Score Condition 0 <6,0000 0-5 6,000-160,000 5 >160,000

### **Elevation**

Variance above 4000' divided by 1000; (Elev-4000)/1000

Score Condition 0 < 4000' 0-5 4000'- 9000' 5 > 9000'

### Carries Mainline

Score Condition

0 Does not carry mainline traffic

5 Carries mainline traffic

### **Detour Scale**

Divides detour length by 10 and multiplies by 2.5

Score Condition
0 0 miles
0-5 0-20 miles
5 > 20 miles

### <u>Scour</u>

#### Variance below 8

 Score
 Condition

 0
 Rating > 8

 0-5
 Rating 8 - 3

 5
 Rating < 3</td>

### Vertical Clearance

Variance below 16' x 2.5; (16 -Clearance) x 2.5

Score Condition 0 >16' 0-5 16'-14' 5 <14'

### **Mobility Performance Area**

- Mainline VMT
- Detour Length
- Buffer Index (PTI-TTI)
- Shoulder width

### **Mainline VMT**

### Exponential equation; score = $5-(5*e^{(ADT*-0.0000139)})$

Score	Condition	
0	<16,000	
0-5	16,000-400,000	
5	>400,000	

### **Buffer Index**

### Buffer Index x 10

Score	Condition
0	Buffer Index = 0.00
0-5	Buffer Index 0.00-0.50
5	Buffer Index > 0.50

### **Detour Length**

Score	Condition
0	Detour < 10 miles
5	Detour > 10 miles

### Shoulder Width

Variance below 10', if	only 1	lane in	each (	direction
------------------------	--------	---------	--------	-----------

Score	Condition
0	10' or above or >1 lane in each direction
0-5	10'-5' and 1 lane in each direction
5	5' or less and 1 lane in each direction

### **Safety Performance Area**

- Mainline Daily Traffic Volume
- Vertical Grade
- Shoulder width (Right)
- Elevation
- Interrupted Flow

### Mainline Daily Traffic Volume

### Exponential equation; score = 5-(5\*e<sup>(ADT\*-0.000039)</sup>)

Score	Condition
0	<6,000
0-5	6,000-160,000
5	>160,000

### Interrupted Flow

Score	Condition
0	Not interrupted flow
5	Interrupted Flow

### Elevation

### Variance above 4000' divided by 1000; (Elev-4000)/1000

Score	Condition
0	< 4000'
0-5	4000'- 9000'
5	> 9000'

### Shoulder (Right side)

#### Variance below 10'

Score	Condition
0	10' or above
0-5	10' - 5'
5	5' or less

#### Grade

### Variance above 3% x 1.5

Score	Condition
0	< 3%
0-5	3% - 6.33%
5	>6.33%

### Freight Performance Area

- Mainline Daily Truck Volume
- Detour Length
- Truck Buffer Index (TPTI-TTTI)
- Shoulder width

### Mainline Daily Truck Volume

### Exponential equation; score = 5-(5\*e<sup>(ADT\*-0.00025)</sup>)

Score	Condition
0	<900
0-5	900-25,000
5	>25,000

### **Detour Length**

Score	Condition
0	Detour < 10 miles
5	Detour > 10 miles

### Truck Buffer Index

### Truck Buffer Index x 10

Score	Condition
0	Buffer Index = 0.00
0-5	Buffer Index 0.00-0.50
5	Buffer Index > 0.50

### Shoulder Width

### Variance below 10', if only 1 lane in each direction

	, ,
Score	Condition
0	10' or above or >1 lane in each direction
0-5	10'-5' and 1 lane in each direction
5	5' or less and 1 lane in each direction

## **Performance Area Risk Factors**

Solution Number	Mainline Traffic Vol (vpd) (2-way)	Solution Length (miles)	Bridge Detour Length (miles) (N19)	Elevation (ft)	Scour Critical Rating (0-9)	Carries Mainline Traffic (Y/N)	Bridge Vert. Clear (ft)	Mainline Truck Vol (vpd) (2-way)	Detour Length > 10 miles (Y/N)	Truck Buffer Index	Non-Truck Buffer Index	Grade (%)	Interrupted Flow (Y/N)	Outside/ Right Shoulder Width (ft)	1-lane each direction
3	39,682	4		6,950				8,980	n	0.14	0.17	3.0	n	10	n
4	39,682	6		6,950				8,980	n	0.14	0.17	3	n	10	n
5	39,682	2		6,950				8,980	n	0.14	0.17	3	n	10	n
6	39,682	1		6,850				8,980	n	0.14	0.17	2.3	n	10	n
7A	39,682	2		6,820				8,980	n	0.14	0.17	2	n	10	n
7B	19,062	5		6,790				6,336	У	0.10	0.31	3.6	n	10	n
8	19,062	2		6,670				6,336	У	0.10	0.31	3.6	n	10	n
9	19,062	5		6,500				6,336	у	0.10	0.31	2.9	n	10	n
10	19,062	4		6,790				6,336	У	0.10	0.31	3.6	n	10	n
11	19,062	3		6,790				6,336	У	0.10	0.31	3	n	10	n
12	16,150	2		5,980				5,446	У	0.09	0.26	2.1	n	10	n
13	16,150	9		5,860				5,446	У	0.09	0.26	2.4	n	10	n
14	16,150	1		5,870				5,446	У	0.09	0.26	2.1	n	10	n
15	16,150	1		5,520				5,446	у	0.09	0.26	2.4	n	10	n
17	16,110	8		4,980				6,196	Υ	0.08	0.2	1.3	N	10	N
24	16,008	6		6,080				6,325	N	0.12	0.3	4.1	N	10	N
25	16,008	9		6,190				6,325	n	0.12	0.3	2.9	N	10	N
26	16,008	3		6,190				6,325	N	0.12	0.3	4.1	N	10	N

6 1								Risk Score (0 to 10	)	
Solution Number	Bridge	Pavement	Mobility	Safety	Freight	Bridge	Pavement	Mobility	Safety	Freight
3			У	У	У	0.00	0.00	3.07	2.75	2.94
4			У	У	У	0.00	0.00	3.26	2.75	2.94
5			У	У	У	0.00	0.00	2.52	2.75	2.94
6			У	у	У	0.00	0.00	1.91	2.71	2.94
7A			У	У	У	0.00	0.00	2.52	2.70	2.94
7B			У	У	У	0.00	0.00	5.88	2.52	4.99
8			У	У	У	0.00	0.00	5.08	2.47	4.99
9			У	У	У	0.00	0.00	5.88	2.04	4.99
10			У	У	У	0.00	0.00	5.68	2.52	4.99
11		У	У	У	У	0.00	6.25	5.42	2.16	4.99
12			У	У	У	0.00	0.00	4.70	1.72	4.81
13			У	У	У	0.00	0.00	5.97	1.67	4.81
14			У	У	У	0.00	0.00	4.30	1.68	4.81
15			у	У	У	0.00	0.00	4.30	1.54	4.81
17			у	У	Υ	0.00	0.00	5.58	1.32	4.87
24			у	У	Υ	0.00	0.00	3.34	2.41	2.59
25			у	У	У	0.00	0.00	3.66	1.80	2.59
26			У	У	Υ	0.00	0.00	2.72	2.46	2.59

**Appendix E: Performance Effectiveness Scores** 

September 2016

# I-40 East Candidate Solution Need Benefit Scoring

			Description	Improvements	Improvements	Improvements	Dutier 11	Improvements	Improvements	Lighting	Safety	Canyon	Tavement	West Curves	Middle	TI	East Curves
	LEGEND	<u>:</u>	Project Beg MP	196	196	198	198.5	200	202	204.5	207	201.5	202	218	220	219.5	229
		- user entered value	Project End MP	200	202	200	199.5	202	207	207.5	212	205.5	205	220	229	220.5	230
		- calculated value for reference only	Project Length (miles)	4	6	2	1	2	5	3	5	4	3	2	9	1	1
		<ul> <li>calculated value for entry/use in other spreadsheet</li> </ul>	Segment Beg MP	196	196	196	196	196	202	202	202	202	202	212	212	212	212
		- for input into Performance Effectiveness	Segment beg wil											212			
		Score spreadsheet	Segment End MP	202	202	202	202	202	212	212	212	212	212	234	234	234	234
		- assumed values (do not modify)	Segment Length (miles)	6	6	6	6	6	10	10	10	10	10	22	22	22	22
			Segment #	1	1	1	1	1	2	2	2	2	2	3	3	3	3
			Current # of Lanes (both directions)	4	4	4	4	4	4	4	4	4	4	4	4	4	4
			Project Type (one-way or two-way)	two-way	two-way	two-way	two-way	two-way	two-way	two-way	two-way	two-way	one-way	two-way	two-way	two-way	two-way
			Additional Lanes (one-way)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Pro-Rated # of Lanes	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
		Notes and Directions	Description			[				1							
		Input current value from performance system (direction 1)	Orig Segment Directional Safety Index (direction 1)	1.558	1.558	1.558	1.558	1.558	2.408	2.408	2.408	2.408	2.408	1.460	1.460	1.460	1.460
		Input current value from performance system (direction 1)	Orig Segment Directional Fatal Crashes (direction 1)	3	3	3	3	3	4	4	4	4	4	5	5	5	5
		Input current value from performance system (direction 1)	Orig Segment Directional Incap Crashes (direction 1)	4	4	4	4	4	5	5	5	5	5	4	4	4	4
		Input current value from performance system (direction 1)	Original Fatal Crashes in project limits (direction 1)	1	2	1	1	2	1	1	3	1	0	2	1	1	0
		Input current value from performance system (direction 1)	Original Incap Crashes in project limits (direction 1)	2	3	0	0	2	2	0	3	2	2	0	3	0	1
		Input CMF value (direction 1) - If no CMF enter 1.0	CMF 1 (direction 1)	0.77	0.75	0.1	0.21	0.67	0.77	0.75		0.21	0.71	0.67	0.77	0.21	0.67
		Input CMF value (direction 1) - If no CMF enter 1.0	CMF 2 (direction 1)	0.87	1	1	1	0.79	0.87	1		1	1	0.79	0.87	1	0.79
	AFETY			0.86	1	1	1	0.87	0.86	1		1	1	0.87	0.86	1	0.87
SAFETY	Ø	Input CMF value (direction 1) - If no CMF enter 1.0	CMF 3 (direction 1)	0.92	1	1	1	0.77	0.92	1		1	1	0.77	1	1	0.77
SAF	CTIONAL	Calculated Value (direction 1)	Total CMF (direction 1)	0.643	0.750	0.100	0.210	0.500	0.643	0.750	0.500	0.210	0.710	0.500	0.670	0.210	0.500
	REC	Calculated Value (direction 1)	Fatal Crash reduction (direction 1)	0.357	0.500	0.900	0.790	1.000	0.357	0.250	1.500	0.790	0.000	1.000	0.330	0.790	0.000
		Calculated Value (direction 1)	Incap Crash reduction (direction 1)	0.714	0.750	0.000	0.000	1.000	0.714	0.000	1.500	1.580	0.580	0.000	0.991	0.000	0.500
		Enter in Safety Index spreadsheet to calculate new Safety Index (direction 1)	Post-Project Segment Directional Fatal Crashes (direction 1)	2.643	2.500	2.100	2.210	2.000	3.643	3.750	2.643	3.210	4.000	4.000	4.670	4.210	5.000
		Enter in Safety Index spreadsheet to calculate new Safety Index (direction 1)	Post-Project Segment Directional Incap Crashes (direction 1)	3.286	3.250	4.000	4.000	3.000	4.286	5.000	3.500	3.420	4.420	4.000	3.009	4.000	3.500
		Input value from updated Safety Index spreadsheet (direction 1)	Post-Project Segment Directional Safety Index (direction 1)	1.360	1.300	1.130	1.180	1.050	2.180	2.270	1.600	1.910	2.390	1.180	1.350	1.240	1.450
		Enter in Safety Needs spreadsheet to calculate new segment level Safety Need (direction 1)	Post-Project Segment Directional Safety Index (direction 1)	1.360	1.300	1.130	1.180	1.050	2.180	2.270	1.600	1.910	2.390	1.180	1.350	1.240	1.450
		Input current value from performance system (direction 2)	Orig Segment Directional Safety Index (direction 2)	1.973	1.973	1.973	1.973	1.973	1.364	1.364	1.364	1.364	1.364	1.230	1.230	1.230	1.230
		Input current value from performance system	Orig Segment Directional Fatal Crashes (direction	4	4	4	4	4	2	2	2	2	2	4	4	4	4

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Appendix E - 1

40.3

Flagstaff Area Safety 40.4

Lighting

40.5

Ped

40.7-A

East Flagstaff Safety

40.6

40.7-B

East Flagstaff Safety 40.9

Winona

40.08

40.10

Country Club

40.11

40.12

Canyon Diablo 40.13

Canyon Diablo 40.14

Twin

Arrows

40.15

Canyon

Diablo

		Solution #	40.3	40.4	40.5	40.6	40.7-A	40.7-B	40.08	40.9	40.10	40.11	40.12	40.13	40.14	40.15
	(direction 2)	2)		-												
	Input current value from performance system (direction 2)	Orig Segment Directional Incap Crashes (direction 2)	2	2	2	2	2	6	6	6	6	6	6	6	6	6
	Input current value from performance system (direction 2)	Original Fatal Crashes in project limits (direction 2)	4	3	3	1	0	1	2	1	0		1	2	1	1
	Input current value from performance system (direction 2)	Original Incap Crashes in project limits (direction 2)	2	1	0	1	0	4	1	2	0		1	3	1	0
	Input CMF value (direction 2) - If no CMF enter 1.0	CMF 1 (direction 2)	0.77	0.75	0.1	0.21	0.67	0.77	0.75		0.21	0.71	0.67	0.77	0.21	0.67
	Input CMF value (direction 2) - If no CMF enter 1.0	CMF 1 (direction 2)	0.87	1	1	1	0.79	0.87	1		1	1	0.79	0.87	1	0.79
			0.86	1	1	1	0.87	0.86	1		1	1	0.87	0.86	1	0.87
	Input CMF value (direction 2) - If no CMF enter 1.0	CMF 1 (direction 2)	0.92	1	1	1	0.77	0.92	1		1	1	0.77	1	1	0.77
	Calculated Value (direction 2)	Total CMF (direction 2)	0.643	0.750	0.100	0.210	0.500	0.643	0.750	0.500	0.210	0.710	0.500	0.670	0.210	0.500
	Calculated Value (direction 2)	Fatal Crash reduction (direction 2)	1.429	0.750	2.700	0.790	0.000	0.357	0.500	0.500	0.000	0.000	0.500	0.661	0.790	0.500
	Calculated Value (direction 2)	Incap Crash reduction (direction 2)	0.714	0.250	0.000	0.790	0.000	1.429	0.250	1.000	0.000	0.000	0.500	0.991	0.790	0.000
	Enter in Safety Index spreadsheet to calculate new Safety Index (direction 2)	Post-Project Segment Directional Fatal Crashes (direction 2)	2.571	3.250	1.300	3.210	4.000	1.643	1.500	1.500	2.000	2.000	3.500	3.339	3.210	3.500
	Enter in Safety Index spreadsheet to calculate new Safety Index (direction 2)	Post-Project Segment Directional Incap Crashes (direction 2)	1.286	1.750	2.000	1.210	2.000	4.571	5.750	5.143	6.000	6.000	5.500	5.009	5.210	6.000
	Input value from updated Safety Index spreadsheet (direction 2)	Post-Project Segment Directional Safety Index (direction 2)	1.270	1.610	0.690	1.570	1.970	1.110	1.070	1.050	1.360	1.360	1.080	1.030	1.000	1.090
	Enter in Safety Needs spreadsheet to calculate new segment level Safety Need (direction 2)	Post-Project Segment Directional Safety Index (direction 2)	1.270	1.610	0.690	1.570	1.970	1.110	1.070	1.050	1.360	1.360	1.080	1.030	1.000	1.090
<u></u> ≿≿	Calculated Value - verify that it matches	Current Safety Index	1.766	1.766	1.766	1.766	1.766	1.886	1.886	1.886	1.886	1.886	1.345	1.345	1.345	1.345
SAFETY	Enter in Safety Needs spreadsheet to calculate new segment level Safety Need	Post-Project Safety Index	1.315	1.455	0.910	1.375	1.510	1.645	1.670	1.325	1.635	1.875	1.130	1.190	1.120	1.270
	User entered value from Safety Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Original Segment Safety Need	5.296	5.296	5.296	5.296	5.296	4.964	4.964	4.964	4.964	4.964	3.164	3.164	3.164	3.164
Need	User entered value from Safety Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Post-Project Segment Safety Need	3.35	3.932	1.198	3.607	4.179	4.150	4.228	3.072	4.117	4.917	2.431	2.617	2.375	2.9
	Input current value from performance system	Original Segment Mobility Index	0.710	0.710	0.710	0.710	0.710	0.420	0.420	0.420	0.420	0.420	0.490	0.490	0.490	0.490
MOBILITY INDEX	Enter in Mobility Index Spreadsheet to determine new segment level Mobility Index	Post-Project # of Lanes (both directions)	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
BILITY	Input value from updated Mobility Index spreadsheet	Post-Project Segment Mobility Index	0.69	0.71	0.71	0.71	0.71	0.42	0.42	0.40	0.42	0.42	0.49	0.49	0.49	0.49
	Enter in Mobility Needs spreadsheet to update segment level Mobility Need	Post-Project Segment Mobility Index	0.687	0.710	0.710	0.710	0.710	0.420	0.420	0.400	0.420	0.420	0.490	0.490	0.490	0.490
MOBILITY	Input current value from performance system	Original Segment Future V/C	0.900	0.900			0.900	0.580		0.580						
\$	Input value from updated Mobility Index	Post-Project Segment Future V/C														
FUT	Enter in Mobility Needs spreadsheet to update segment level Mobility Need	Post-Project Segment Future V/C	0.876 0.876	0.900	0.000	0.000	0.900	0.580 0.580	0.000	0.553 0.553	0.000		0.000	0.000	0.000	0.000
PEAK		Original Segment Peak Hour V/C (direction 1)	0.400	0.400			0.400	0.200		0.200						
PE/	Input current value from performance system	Original Segment Peak Hour V/C (direction 1)	0.400	0.400			0.400	0.200		0.200						

(direction 2)	Solution #	40.3	40.4	40.5	40.6	40.7-A	40.7-B	40.08	40.9	40.10	40.11	40.12	40.13	40.14	
*If One-Way project, enter in Mobility Index Spreadsheet to determine new segment level Peak Hour V/C. If Two-Way project, disregard	Adjusted total # of Lanes for use in directional peak hr	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	
Input value from updated Mobility Index spreadsheet (direction 1)	Post-Project Segement Peak Hr V/C (direction 1)	0.376	0.40						0.18						
Input value from updated Mobility Index	5 / 5 / 7 / 7 / 7 / 7 / 7 / 7	0.070	0.00						0.45						
spreadsheet (direction 2)  Enter in Mobility Needs spreadsheet to update segment level Mobility Need	Post-Project Segement Peak Hr V/C (direction 2)  Post-Project Segment Peak Hr V/C (direction 1)	0.372	0.39	0.000	0.000	0.000	0.000	0.000	0.15 0.183	0.000		0.000	0.000	0.000	
Enter in Mobility Needs spreadsheet to update segment level Mobility Need	Post-Project Segment Peak Hr V/C (direction 2)	0.372	0.390	0.000	0.000	0.000	0.000	0.000	0.149	0.000		0.000	0.000	0.000	
Calculated Value (both directions)	Safety Reduction Factor	0.745	0.824	0.515	0.779	0.855	0.872	0.885	0.703	0.867	0.994	0.840	0.885	0.833	T
Calculated Value (both directions)	Safety Reduction	0.255	0.176	0.485	0.221	0.145	0.128	0.115	0.297	0.133	0.006	0.160	0.115	0.167	T
Calculated Value (both directions)	Mobility Reduction Factor	0.968	1.000	1.000	1.000	1.000	1.000	1.000	0.952	1.000	1.000	1.000	1.000	1.000	Ť
Calculated Value (both directions)	Mobility Reduction	0.032	0.000	0.000	0.000	0.000	0.000	0.000	0.048	0.000	0.000	0.000	0.000	0.000	Ť
Input current value from performance system (direction 1)	Original Directional Segment TTI (direction 1)	1.010	1.010		1.010	1.010	1.000	1.000	1.000	1.000		1.000	1.000	1.000	
Input current value from performance system (direction 1)	Original Directional Segment PTI (direction 1)	1.130	1.130	1.130	1.130	1.130	1.210	1.210	1.210	1.210	1.210	1.230	1.230	1.230	İ
Input current value from performance system (direction 2)	Original Directional Segment TTI (direction 2)	1.030	1.030		1.030	1.030	1.000	1.000	1.000	1.000		1.000	1.000	1.000	Ī
Input current value from performance system (direction 2)	Original Directional Segment PTI (direction 2)	1.200	1.200	1.200	1.200	1.200	1.310	1.310	1.310	1.310	1.310	1.260	1.260	1.260	
Calculated Value (both directions)	Reduction Factor for Segment TTI	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.014	0.000	0.000	0.000	0.000	0.000	
Calculated Value (both directions)	Reduction Factor for Segment PTI	0.083	0.053	0.145	0.066	0.043	0.038	0.034	0.099	0.040	0.002	0.048	0.035	0.050	
Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 1)	Post-Project Directional Segment TTI (direction 1)	1.000	1.010	0.500	1.010	1.010	1.000	1.000	1.000	1.000	0.500	1.000	1.000	1.000	
Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 1)	Post-Project Directional Segment PTI (direction 1)	1.036	1.070	1.065	1.055	1.081	1.164	1.168	1.091	1.162	1.208	1.171	1.187	1.168	
Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 2)	Post-Project Directional Segment TTTI (direction 2)	1.020	1.030	0.500	1.030	1.030	1.000	1.000	1.000	1.000	0.000	1.000	1.000	1.000	
Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 2)	Post-Project Directional Segment TPTI (direction 2)	1.100	1.137	1.026	1.120	1.148	1.260	1.265	1.181	1.258	1.31	1.200	1.216	1.197	
Input current value from performance system (direction 1)	Orig Segment Directional Closure Extent (direction 1)	0.630	0.630	0.630	0.630	0.630	0.540	0.540	0.540	0.540	0.540	0.510	0.510	0.510	
Input current value from performance system (direction 2)	Orig Segment Directional Closure Extent (direction 2)	0.170	0.170	0.170	0.170	0.170	0.200	0.200	0.200	0.200	0.200	0.110	0.110	0.110	
Input value from HCRS	Segment Closures with fatalities/injuries	10	10	10	10	10	14	14	14	14	14	17	17	17	1
Input value from HCRS	Total Segment Closures	14	14	14	14	14	19	19	19	19	19	26	26	26	
Calculated Value (both directions)	% Closures with Fatality/Injury	0.71	0.71	0.71	0.71	0.71	0.74	0.74	0.74	0.74	0.74	0.65	0.65	0.65	
Calculated Value (both directions)	Closure Reduction	0.182	0.126	0.346	0.158	0.103	0.094	0.084	0.219	0.098	0.004	0.105	0.075	0.109	
Calculated Value (both directions)	Closure Reduction Factor	0.818	0.874	0.654	0.842	0.897	0.906	0.916	0.781	0.902	0.996	0.895	0.925	0.891	
Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 1)	Post-Project Segment Directional Closure Extent (direction 1)	0.515	0.551	0.412	0.530	0.565	0.489	0.494	0.422	0.487	0.538	0.457	0.472	0.454	
Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction	Post-Project Segment Directional Closure Extent (direction 2)	0.139	0.149	0.111	0.143	0.152	0.181	0.183	0.156	0.180	0.200	0.099	0.102	0.098	Ī

			Solution#	40.3	40.4	40.5	40.6	40.7-A	40.7-B	40.08	40.9	40.10	40.11	40.12	40.13	40.14	40.15
		2)															
		Input current value from perfermance eveter	Orig Segment Bicycle Accomodation %	100.0%	100.0%		100.0%	100.00/	100.00/								
	Σ	Input current value from performance system  Input current value from performance system	Orig Segment Outside Shoulder width	100.0%	100.0%		100.0%	100.0%	100.0%								
	ACCOM	Input value from updated Mobility Index		10			10	10	10								
	LE A	spreadsheet	Post-Project Segment Outside Shoulder width		10												
	BICYCLE	Input value from updated Mobility Index spreadsheet	Post-Project Segment Bicycle Accommodation (%)		100.0%												
	8	Enter in Mobility Needs spreadsheet to calculate new segment level Mobility Need	Post-Project Segment Bicycle Accommodation (%)	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%		0.0%	0.0%		0.0%	0.0%	0.0%	0.0%
	Needs	User entered value from Mobility Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Original Segment Mobility Need	1.326	1.326	1.326	1.326	1.326	0.745	0.745	0.745	0.745	0.745	1.063	1.063	1.063	1.063
	Needs	User entered value from Mobility Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Post-Project Segment Mobility Need	1.213	1.289	1.200	1.279	1.296	0.719	0.722	0.642	0.718	0.744	1.026	1.038	1.023	1.053
		Input current value from performance system (direction 1)	Original Directional Segment TTTI (direction 1)	1.050	1.050	1.050	1.050	1.050	1.020	1.020	1.020	1.020	1.020				
		Input current value from performance system (direction 1)	Original Directional Segment TPTI (direction 1)	1.160	1.160	1.160	1.160	1.160	1.100	1.100	1.100	1.100	1.100	1.120	1.120	1.120	1.120
		Input current value from performance system (direction 2)	Original Directional Segment TTTI (direction 2)	1.080	1.080	1.080	1.080	1.080	1.060	1.060	1.060	1.060	1.060				
		Input current value from performance system (direction 2)	Original Directional Segment TPTI (direction 2)	1.210	1.210	1.210	1.210	1.210	1.160	1.160	1.160	1.160	1.160	1.130	1.130	1.130	1.130
	TPTI	Calculated Value (both directions)	Reduction Factor for Segment TTTI (both directions)	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.000	0.000	0.000	0.000	0.000
	AND	Calculated Value (both directions)	Reduction Factor for Segment TPTI (both directions)	0.042	0.026	0.073	0.033	0.022	0.019	0.017	0.049	0.020	0.001	0.024	0.017	0.025	0.008
	Ē	Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 1)	Post-Project Directional Segment TTTI (direction 1)	1.045	1.050	1.050	1.050	1.050	1.020	1.020	1.013	1.020	1.020	0.000	0.000	0.000	0.000
		Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 1)	Post-Project Directional Segment TPTI (direction 1)	1.112	1.129	1.076	1.122	1.135	1.079	1.081	1.046	1.078	1.099	1.093	1.101	1.092	1.111
		Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 2)	Post-Project Directional Segment TTTI (direction 2)	1.075	1.080	1.080	1.080	1.080	1.060	1.060	1.052	1.060	1.060	0.500	0.500	0.500	0.500
REIGHT		Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 2)	Post-Project Directional Segment TPTI (direction 2)	1.160	1.178	1.122	1.170	1.184	1.138	1.140	1.103	1.137	1.160	1.103	1.110	1.102	1.121
ᇤ		Value from above	Original Segment TPTI (direction 1)	1.160	1.160	1.160	1.160	1.160	1.100	1.100	1.100	1.100	1.100	1.120	1.120	1.120	1.120
	×	Value from above	Original Segment TPTI (direction 2)	1.210	1.210	1.210	1.210	1.210	1.160	1.160	1.160	1.160	1.160	1.130	1.130	1.130	1.130
	FREIGHT INDEX	Calculated Value	Original Segment Freight Index	0.844	0.844	0.844	0.844	0.844	0.885	0.885	0.885	0.885	0.885	0.889	0.889	0.889	0.889
	FE	Calculated Value	Post-Project Segment TPTI (direction 1)	1.112	1.129	1.076	1.122	1.135	1.079	1.081	1.046	1.078	1.099	1.093	1.101	1.092	1.111
	REI	Calculated Value	Post-Project Segment TPTI (direction 2)	1.160	1.178	1.122	1.170	1.184	1.138	1.140	1.103	1.137	1.160	1.103	1.110	1.102	1.121
	L	Enter in Freight Needs spreadsheet to update segment level Freight Need	Post-Project Segment Freight Index	0.880	0.867	0.910	0.873	0.863	0.902	0.900	0.931	0.903	0.885	0.911	0.905	0.912	0.896
	NO	Input current value from performance system (direction 1)	Orig Segment Directional Closure Duration (dir 1)	240.700	240.700	240.700	240.700	240.700	211.460	211.460	211.460	211.460	211.460	219.430	219.430	219.430	219.430
	CLOSURE DURATION	Input current value from performance system (direction 2)	Orig Segment Directional Closure Duration (dir 2)	21.100	21.100	21.100	21.100	21.100	76.440	76.440	76.440	76.440	76.440	26.300	26.300	26.300	26.300
	E DL	Calculated Value	Segment Closures with fatalities	10	10	10	10	10	14	14	14	14	14	17	17	17	17
	SUR	Calculated Value	Total Segment Closures	14	14	14	14	14	19	19	19	19	19	26	26	26	26
	CLO	Calculated Value	% Closures with Fatality	0.71	0.71	0.71	0.71	0.71	0.74	0.74	0.74	0.74	0.74	0.65	0.65	0.65	0.65
		Calculated Value	Closure Reduction	0.182	0.126	0.346	0.158	0.103	0.094	0.084	0.219	0.098	0.004	0.105	0.075	0.109	0.036

			Solution #	40.3	40.4	40.5	40.6	40.7-A	40.7-B	40.08	40.9	40.10	40.11	40.12	40.13	40.14	40.15
		Calculated Value	Closure Reduction Factor	0.818	0.874	0.654	0.842	0.897	0.906	0.916	0.781	0.902	0.996	0.895	0.925	0.891	0.964
		Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 1)	Post-Project Segment Directional Closure Duration (direction 1)	196.829	210.463	157.389	202.672	215.819	191.550	193.615	165.113	190.724	210.551	196.496	202.896	195.429	211.430
		Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 2)	Post-Project Segment Directional Closure Duration (direction 2)	17.254	18.449	13.797	17.766	18.919	69.243	69.989	59.686	68.944	76.440	23.551	24.318	23.423	25.341
		Input current value from performance system	Original Segment Vertical Clearance														
		Input current value from performance system	Original vertical clearance for specific bridge														
	<b>L</b>	Input post-project value (depends on solution)	Post-Project vertical clearance for specific bridge														
	VERT	Input post-project value (depends on solution)(force segment clearance to equal this specific bridge)	Post-Project Segment Vertical Clearance														
		Enter in Freight Needs spreadsheet to update segment level Freight Need	Post-Project Segment Vertical Clearance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			0.00	0.00	0.00	0.00
	Needs	User entered value from Freight Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Original Segment Freight Need	0.829	0.829		0.829	0.829	0.982	0.982	0.982	0.982	0.982	0.607	0.607	0.607	0.607
	Necus	User entered value from Freight Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Post-Project Segment Freight Need	0.741	0.769		0.753	0.779	0.922	0.947	0.863	0.920	0.98	0.56	0.573	0.558	0.59
		Input current value from performance system	Original Segment Bridge Index														
		Input current value from performance system	Original lowest rating for specific bridge														
	₩×	Input post-project value (For repair +1, rehab +2, replace=8)	Post-Project lowest rating for specific bridge														
	BRIDGE INDEX	Enter in Bridge Index spreadsheet to calculate new Bridge Index	Post-Project lowest rating for specific bridge	0	0	0	0	0	0		0			0	0	0	0
	<u> </u>	Input updated segment value from updated Bridge Index spreadsheet	Post-Project Segment Bridge Index														
		Enter in Bridge Needs spreadsheet to update segment level Bridge Need	Post-Project Segment Bridge Index	0.00	0.00	0.00	0.00	0.00	0.00		0.00			0.00	0.00	0.00	0.00
		Input current value from performance system	Original Segment Sufficiency Rating														
		Input current value from performance system	Original Sufficiency Rating for specific bridge														
GE	Ø	Input post-project value (For repair +10, rehab +20, replace=98)	Post-Project Sufficiency Rating for specific bridge														
BRIDGE	SUFF	Enter in Bridge Index spreadsheet to calculate new Bridge Index	Post-Project Sufficiency Rating for specific bridge	0.00	0.00	0.00	0.00	0.00	0.00		0.00			0.00	0.00	0.00	0.00
		Input updated segment value from updated Bridge Index spreadsheet	Post-Project Segment Sufficiency Rating														
		Enter in Bridge Needs spreadsheet to update segment level Bridge Need	Post-Project Segment Sufficiency Rating	0.00	0.00	0.00	0.00	0.00	0.00		0.00			0.00	0.00	0.00	0.00
		Input current value from performance system	Original Segment Bridge Rating														
	BR	Input updated segment value from updated Bridge Index spreadsheet	Post-Project Segment Bridge Rating														
	<u>.</u> .	Enter in Bridge Needs spreadsheet to update segment level Bridge Need	Post-Project Segment Bridge Rating	0	0	0	0	0	0		0			0	0	0	0
	z	Input current value from performance system	Original Segment % Functionally Obsolete														
	% FUN OB	Input updated value from updated Bridge Index spreadsheet (only remove bridge from FO if replace or rehab)	Post-Project Segment % Functionally Obsolete														

			Solution #	40.3	40.4	40.5	40.6	40.7-A	40.7-B	40.08	40.9	40.10	40.11	40.12	40.13	40.14	40.15
		Enter in Bridge Needs spreadsheet to update segment level Bridge Need	Post-Project Segment % Functionally Obsolete	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%		0.00%			0.00%	0.00%	0.00%	0.00%
	Needs	User entered value from Bridge Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Original Segment Bridge Need														
	Neeus	User entered value from Bridge Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Post-Project Segment Bridge Need														
		Input current value from performance system	Original Segment Pavement Index										3.83				
		Input current value from performance system	Original Segment IRI in project limits										100				
		Input current value from performance system	Original Segment Cracking in project limits										0				
		Input post-project value (For rehab, increase to 45; for replace increase to 30)	Post-Project IRI in project limits										45				
	ENT	Enter in Pavement Index spreadsheet to calculate new Pavement Index	Post-Project IRI in project limits	0	0	0	0	0	0		0		45	0	0	0	0
	PAVEMENT INDEX	Input post-project value (Lower to 0 for rehab or replace)	Post-Project Cracking in project limits										0				
		Enter in Pavement Index spreadsheet to calculate new Pavement Index	Post-Project Cracking in project limits	0	0	0	0	0	0		0		0	0	0	0	0
		Input updated segment value from updated Pavement Index spreadsheet	Post-Project Segment Pavement Index										3.91				
		Enter in Pavement Needs spreadsheet to update segment level Pavement Need	Post-Project Segment Pavement Index	0	0	0	0	0	0		0		3.91	0	0	0	0
N.		Input current value from performance system (direction 1)	Original Segment Directional PSR (direction 1)										3.47				
PAVEMENT		Input current value from performance system (direction 2)	Original Segment Directional PSR (direction 2)										3.85				
Æ		Value from above	Original Segment IRI in project limits	0	0	0	0	0	0		0		100	0	0	0	0
		Value from above	Post-Project directional IRI in project limits	0	0	0	0	0	0		0		45	0	0	0	0
	ECTION	Input updated segment value from updated Pavement Index spreadsheet (direction 1)	Post-Project Segment Directional PSR (direction 1)										3.71				
	DIRE(	Input updated segment value from updated Pavement Index spreadsheet (direction 2)	Post-Project Segment Directional PSR (direction 2)										3.85				
		Enter in Pavement Needs spreadsheet to update segment level Pavement Need	Post-Project Segment Directional PSR (direction 1)	0	0	0	0	0	0		0		3.71	0	0	0	0
		Enter in Pavement Needs spreadsheet to update segment level Pavement Need	Post-Project Segment Directional PSR (direction 2)	0	0	0	0	0	0		0		3.85	0	0	0	0
		Input current value from performance system	Original Segment % Failure										25.0%				
	% FAIL	Input value from updated Pavement Index spreadsheet	Post-Project Segment % Failure										20.0%				
	β	Enter in Pavement Needs spreadsheet to update segment level Pavement Need	Post-Project Segment % Failure	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		0.0%		20.0%	0.0%	0.0%	0.0%	0.0%
	Needs	User entered value from Pavement Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Original Segment Pavement Need										0.603				

	Solution #	40.3	40.4	40.5	40.6	40.7 <b>-</b> A	40.7-B	40.08	40.9	40.10	40.11	40.12	40.13	40.14	40.15
User entered value from Pavement Needs	Don't Desired Command Desirement Novel										0.442				
spreadsheet and for use in Performance Effectiveness spreadsheet	Post-Project Segment Pavement Need										0.413				

LEGEND:	
	- user entered value
	- calculated value for reference only
	- calculated value for entry/use in other spreadsheet
	- for input into Performance Effectiveness Score spreadsheet
	- assumed values (do not modify)

Solution #	40.17	40.24	40.25	40.26
	East Winslow	Luption West	Lupton East	Lupton TI's
Description				
Project Beg MP	258	345	351	347.5
Project End MP	266	351	360	359.5
Project Length (miles)	8	6	9	12
Segment Beg MP	258	342	342	342
Segment End MP	270	360	360	360
Segment Length (miles)	12	18	18	18
Segment #	6	12	12	12
Current # of Lanes (both directions)	4	4	4	4
Project Type (one-way or two-way)	two-way	two-way	two-way	two-way
Additional Lanes (one-way)	0	0	0	0
Pro-Rated # of Lanes	4.00	4.00	4.00	4.00

		Notes and Directions	Description				
		Input current value from performance system (direction 1)	Orig Segment Directional Safety Index (direction 1)	1.160	1.770	1.770	1.770
		Input current value from performance system (direction 1)	Orig Segment Directional Fatal Crashes (direction 1)	2	5	5	5
		Input current value from performance system (direction 1)	Orig Segment Directional Incap Crashes (direction 1)	4	3	3	3
		Input current value from performance system (direction 1)	Original Fatal Crashes in project limits (direction 1)	1	3	1	1
		Input current value from performance system (direction 1)	Original Incap Crashes in project limits (direction 1)	3	1	2	1
		Input CMF value (direction 1) - If no CMF enter 1.0	CMF 1 (direction 1)			0.77	0.21
		Input CMF value (direction 1) - If no CMF enter 1.0	CMF 2 (direction 1)			0.87	1
						1	1
		Input CMF value (direction 1) - If no CMF enter 1.0	CMF 3 (direction 1)			1	1
	<b>&gt;</b>	Calculated Value (direction 1)	Total CMF (direction 1)	0.500	0.500	0.720	0.210
	SAFETY	Calculated Value (direction 1)	Fatal Crash reduction (direction 1)	0.500	1.500	0.280	0.790
<b>≥</b>		Calculated Value (direction 1)	Incap Crash reduction (direction 1)	1.500	0.500	0.560	0.790
SAFETY	DIRECTIONAL	Enter in Safety Index spreadsheet to calculate new Safety Index (direction 1)	Post-Project Segment Directional Fatal Crashes (direction 1)	1.554	3.936	4.720	4.210
	DIRE	Enter in Safety Index spreadsheet to calculate new Safety Index (direction 1)	Post-Project Segment Directional Incap Crashes (direction 1)	3.160	2.496	2.440	2.210
		Input value from updated Safety Index spreadsheet (direction 1)	Post-Project Segment Directional Safety Index (direction 1)	0.900	1.400	1.670	1.490
		Enter in Safety Needs spreadsheet to calculate new segment level Safety Need (direction 1)	Post-Project Segment Directional Safety Index (direction 1)	0.900	1.400	1.670	1.490
		Input current value from performance system (direction 2)	Orig Segment Directional Safety Index (direction 2)	1.130	0.710	0.710	0.710
		Input current value from performance system (direction 2)	Orig Segment Directional Fatal Crashes (direction 2)	2	2	2	2
		Input current value from performance system (direction 2)	Orig Segment Directional Incap Crashes (direction 2)	3	1	1	1
		Input current value from performance system (direction 2)	Original Fatal Crashes in project limits (direction 2)	2	0	2	0
		Input current value from performance system (direction 2)	Original Incap Crashes in project limits (direction 2)	2	1	0	1
		Input CMF value (direction 2) - If no CMF enter 1.0	CMF 1 (direction 2)		0.67	0.77	0.21

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Appendix E - 8

Working Paper #6

		Input CMF value (direction 2) - If no CMF enter 1.0	CMF 1 (direction 2)		0.77	0.87	1
		input oith value (uncolion 2) - it no oith criter 1.0	OWI 1 (direction 2)		0.79	0.07	1
		Input CMF value (direction 2) - If no CMF enter 1.0	CMF 1 (direction 2)		0.73	1	1
		Calculated Value (direction 2)	Total CMF (direction 2)	0.500	0.500	0.720	0.210
		Calculated Value (direction 2)	Fatal Crash reduction (direction 2)	1.000	0.000	0.560	0.000
		Calculated Value (direction 2)	Incap Crash reduction (direction 2)	1.000	0.500	0.000	0.790
		Enter in Safety Index spreadsheet to calculate new Safety Index (direction 2)	Post-Project Segment Directional Fatal Crashes (direction 2)	1.274	2.000	1.440	2.000
		Enter in Safety Index spreadsheet to calculate new Safety Index (direction 2)	Post-Project Segment Directional Incap Crashes (direction 2)	2.274	0.720	1.000	0.210
		Input value from updated Safety Index spreadsheet (direction 2)	Post-Project Segment Directional Safety Index (direction 2)	0.730	0.700	0.520	0.690
		Enter in Safety Needs spreadsheet to calculate new segment level Safety Need (direction 2)	Post-Project Segment Directional Safety Index (direction 2)	0.730	0.700	0.520	0.690
	<b>≻</b>	Calculated Value - verify that it matches current performance system	Current Safety Index	1.145	1.240	1.240	1.240
	SAFETY	Enter in Safety Needs spreadsheet to calculate new segment level Safety Need	Post-Project Safety Index	0.815	1.050	1.095	1.090
		User entered value from Safety Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Original Segment Safety Need	2.269	2.292	2.292	2.292
	Needs	User entered value from Safety Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Post-Project Segment Safety Need	0.837	1.552	1.854	1.799
		Input current value from performance system	Original Segment Mobility Index	0.390	0.470	0.470	0.470
	MOBILITY INDEX	Enter in Mobility Index Spreadsheet to determine new segment level Mobility Index	Post-Project # of Lanes (both directions)	4.00	4.00	4.00	4.00
	OBILIT	Input value from updated Mobility Index spreadsheet	Post-Project Segment Mobility Index	0.39	0.47	0.47	0.47
	Σ	Enter in Mobility Needs spreadsheet to update segment level Mobility Need	Post-Project Segment Mobility Index	0.390	0.470	0.470	0.470
		Input current value from performance system	Original Segment Future V/C				
	NC NC	Input value from updated Mobility Index spreadsheet	Post-Project Segment Future V/C				
MOBILITY	FUT	Enter in Mobility Needs spreadsheet to update segment level Mobility Need	Post-Project Segment Future V/C	0.000	0.000	0.000	0.000
MOE		Input current value from performance system (direction 1)	Original Segment Peak Hour V/C (direction 1)				
		Input current value from performance system (direction 2)	Original Segment Peak Hour V/C (direction 2)				
	PEAK HOUR V/C	*If One-Way project, enter in Mobility Index Spreadsheet to determine new segment level Peak Hour V/C. If Two-Way project, disregard	Adjusted total # of Lanes for use in directional peak hr	N/A	N/A	N/A	N/A
	НОП	Input value from updated Mobility Index spreadsheet (direction 1)	Post-Project Segement Peak Hr V/C (direction 1)				
	EAK	Input value from updated Mobility Index spreadsheet (direction 2)	Post-Project Segement Peak Hr V/C (direction 2)				
	₹	Enter in Mobility Needs spreadsheet to update segment level Mobility Need	Post-Project Segment Peak Hr V/C (direction 1)	0.000	0.000	0.000	0.000

	Calculated Value (both directions)	Safety Reduction Factor	0.712	0.847	0.883	0.879
	Calculated Value (both directions)	Safety Reduction	0.288	0.153	0.117	0.121
	Calculated Value (both directions)	Mobility Reduction Factor	1.000	1.000	1.000	1.000
	Calculated Value (both directions)	Mobility Reduction	0.000	0.000	0.000	0.000
	Input current value from performance system (direction 1)	Original Directional Segment TTI (direction 1)	0.000	3.333	0.000	0.000
	Input current value from performance system (direction 1)	Original Directional Segment PTI (direction 1)	1.200	1.240	1.240	1.240
	Input current value from performance system (direction 2)	Original Directional Segment TTI (direction 2)				
_	Input current value from performance system (direction 2)	Original Directional Segment PTI (direction 2)	1.190	1.300	1.300	1.300
TTI AND PTI	Calculated Value (both directions)	Reduction Factor for Segment TTI	0.000	0.000	0.000	0.000
A	Calculated Value (both directions)	Reduction Factor for Segment PTI	0.086	0.046	0.035	0.036
F	Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 1)	Post-Project Directional Segment TTI (direction 1)	0.500	0.500	0.500	0.500
	Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 1)	Post-Project Directional Segment PTI (direction 1)	1.096	1.183	1.197	1.195
	Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 2)	Post-Project Directional Segment TTTI (direction 2)	0.500	0.500	0.500	0.500
	Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 2)	Post-Project Directional Segment TPTI (direction 2)	1.087	1.24	1.254	1.253
	Input current value from performance system (direction 1)	Orig Segment Directional Closure Extent (direction 1)	0.110	0.110	0.110	0.110
	Input current value from performance system (direction 2)	Orig Segment Directional Closure Extent (direction 2)	0.000	0.110	0.110	0.110
<b>-</b>	Input value from HCRS	Segment Closures with fatalities/injuries	3	9	9	9
CLOSURE EXTENT	Input value from HCRS	Total Segment Closures	6	17	17	17
	Calculated Value (both directions)	% Closures with Fatality/Injury	0.50	0.53	0.53	0.53
SUF	Calculated Value (both directions)	Closure Reduction	0.144	0.081	0.062	0.064
CLC	Calculated Value (both directions)	Closure Reduction Factor	0.856	0.919	0.938	0.936
	Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 1)	Post-Project Segment Directional Closure Extent (direction 1)	0.094	0.101	0.103	0.103
	Enter in Mobility Needs spreadsheet to update segment level Mobility Need (direction 2)	Post-Project Segment Directional Closure Extent (direction 2)	0.000	0.101	0.103	0.103
_	Input current value from performance system	Orig Segment Bicycle Accomodation %				
WOO	Input current value from performance system	Orig Segment Outside Shoulder width				
. AC	Input value from updated Mobility Index spreadsheet	Post-Project Segment Outside Shoulder width				
BICYCLE ACCO	Input value from updated Mobility Index spreadsheet	Post-Project Segment Bicycle Accomodation (%)				
BIC	Enter in Mobility Needs spreadsheet to calculate new segment level Mobility Need	Post-Project Segment Bicycle Accomodation (%)	0.0%	0.0%	0.0%	0.0%
Needs	User entered value from Mobility Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Original Segment Mobility Need	0.609	0.810	0.810	0.810
110003	User entered value from Mobility Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Post-Project Segment Mobility Need	0.599	0.807	0.803	0.804
	Input current value from performance system (direction 1)	Original Directional Segment TTTI (direction 1)				
IPT.	Input current value from performance system (direction 1)	Original Directional Segment TPTI (direction 1)	1.110	1.130	1.130	1.130
LON	Input current value from performance system (direction 2)	Original Directional Segment TTTI (direction 2)				
TTTI AND TPTI	Input current value from performance system (direction 2)	Original Directional Segment TPTI (direction 2)	1.090	1.150	1.150	1.150
=	Calculated Value (both directions)	Reduction Factor for Segment TTTI (both directions)	0.000	0.000	0.000	0.000
	Calculated Value (both directions)	Reduction Factor for Segment TPTI (both directions)	0.043	0.023	0.018	0.018

	Futurin Fariable Needs assessed best to undetendent build Fariable Need (dispetion 4)	Deat Desirat Directional Convent TTTI (direction 4)	0.000	0.000	0.000	0.000
	Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 1)	Post-Project Directional Segment TTTI (direction 1)	0.000	0.000	0.000	0.000
	Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 1)	Post-Project Directional Segment TPTI (direction 1)	1.062	1.104	1.110	1.109
	Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 2)	Post-Project Directional Segment TTTI (direction 2)	0.500	0.500	0.500	0.500
	Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 2)	Post-Project Directional Segment TPTI (direction 2)	1.043	1.124	1.130	1.129
	Value from above	Original Segment TPTI (direction 1)	1.110	1.130	1.130	1.130
Ä	Value from above	Original Segment TPTI (direction 2)	1.090	1.150	1.150	1.150
	Calculated Value	Original Segment Freight Index	0.909	0.877	0.877	0.877
FREIGHT INDEX	Calculated Value	Post-Project Segment TPTI (direction 1)	1.062	1.104	1.110	1.109
I E	Calculated Value	Post-Project Segment TPTI (direction 2)	1.043	1.124	1.130	1.129
	Enter in Freight Needs spreadsheet to update segment level Freight Need	Post-Project Segment Freight Index	0.950	0.898	0.893	0.893
	Input current value from performance system (direction 1)	Orig Segment Directional Closure Duration (dir 1)	23.770	25.540	25.540	25.540
	Input current value from performance system (direction 2)	Orig Segment Directional Closure Duration (dir 2)	0.000	36.650	36.650	36.650
Z	Calculated Value	Segment Closures with fatalities	3	9	9	9
ATIC	Calculated Value	Total Segment Closures	6	17	17	17
DUR	Calculated Value	% Closures with Fatality	0.50	0.53	0.53	0.53
J.R.	Calculated Value	Closure Reduction	0.144	0.081	0.062	0.064
CLOSURE DURATION	Calculated Value	Closure Reduction Factor	0.856	0.919	0.938	0.936
5	Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 1)	Post-Project Segment Directional Closure Duration (direction 1)	20.345	23.468	23.959	23.904
	Enter in Freight Needs spreadsheet to update segment level Freight Need (direction 2)	Post-Project Segment Directional Closure Duration (direction 2)	0.000	33.677	34.381	34.303
	Input current value from performance system	Original Segment Vertical Clearance				
	Input current value from performance system	Original vertical clearance for specific bridge				
<b>₽</b> ~	Input post-project value (depends on solution)	Post-Project vertical clearance for specific bridge				
VERT	Input post-project value (depends on solution)(force segment clearance to equal this specific bridge)	Post-Project Segment Vertical Clearance				
	Enter in Freight Needs spreadsheet to update segment level Freight Need	Post-Project Segment Vertical Clearance	0.00	0.00	0.00	0.00
Noodo	User entered value from Freight Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Original Segment Freight Need	0.182	0.577	0.577	0.577
Needs	User entered value from Freight Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Post-Project Segment Freight Need	0.176	0.571	0.573	0.572
	Input current value from performance system	Original Segment Bridge Index				
	Input current value from performance system	Original lowest rating for specific bridge				
쁑x	Input post-project value (For repair +1, rehab +2, replace=8)	Post-Project lowest rating for specific bridge				
BRIDGE	Enter in Bridge Index spreadsheet to calculate new Bridge Index	Post-Project lowest rating for specific bridge	0	0	0	0
	Input updated segment value from updated Bridge Index spreadsheet	Post-Project Segment Bridge Index				
	Enter in Bridge Needs spreadsheet to update segment level Bridge Need	Post-Project Segment Bridge Index	0.00	0.00	0.00	0.00
	Input current value from performance system	Original Segment Sufficiency Rating				
45	Input current value from performance system	Original Sufficiency Rating for specific bridge				
SUFF	Input post-project value (For repair +10, rehab +20, replace=98)	Post-Project Sufficiency Rating for specific bridge				
SI RA	Enter in Bridge Index spreadsheet to calculate new Bridge Index	Post-Project Sufficiency Rating for specific bridge	0.00	0.00	0.00	0.00
	Input updated segment value from updated Bridge Index spreadsheet	Post-Project Segment Sufficiency Rating				

		Enter in Bridge Needs spreadsheet to update segment level Bridge Need	Post-Project Segment Sufficiency Rating	0.00	0.00	0.00	0.00
		Input current value from performance system	Original Segment Bridge Rating				
	BR RTNG	Input updated segment value from updated Bridge Index spreadsheet	Post-Project Segment Bridge Rating				
	B RTI	Enter in Bridge Needs spreadsheet to update segment level Bridge Need	Post-Project Segment Bridge Rating	0	0	0	0
		Input current value from performance system	Original Segment % Functionally Obsolete				
	% FUN OB	Input updated value from updated Bridge Index spreadsheet (only remove bridge from FO if replace or rehab)	Post-Project Segment % Functionally Obsolete				
		Enter in Bridge Needs spreadsheet to update segment level Bridge Need	Post-Project Segment % Functionally Obsolete	0.00%	0.00%	0.00%	0.00%
	Needs	User entered value from Bridge Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Original Segment Bridge Need				
	110000	User entered value from Bridge Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Post-Project Segment Bridge Need				
		Input current value from performance system	Original Segment Pavement Index				
	PAVEMENT INDEX	Input current value from performance system	Original Segment IRI in project limits				
		Input current value from performance system	Original Segment Cracking in project limits				
		Input post-project value (For rehab, increase to 45; for replace increase to 30)	Post-Project IRI in project limits				
		Enter in Pavement Index spreadsheet to calculate new Pavement Index	Post-Project IRI in project limits	0	0	0	0
	PAVE INI	Input post-project value (Lower to 0 for rehab or replace)	Post-Project Cracking in project limits				
		Enter in Pavement Index spreadsheet to calculate new Pavement Index	Post-Project Cracking in project limits	0	0	0	0
		Input updated segment value from updated Pavement Index spreadsheet	Post-Project Segment Pavement Index				
		Enter in Pavement Needs spreadsheet to update segment level Pavement Need	Post-Project Segment Pavement Index	0	0	0	0
-		Input current value from performance system (direction 1)	Original Segment Directional PSR (direction 1)				
		Input current value from performance system (direction 2)	Original Segment Directional PSR (direction 2)				
Z AVEIM		Value from above	Original Segment IRI in project limits	0	0	0	0
2	NO	Value from above	Post-Project directional IRI in project limits	0	0	0	0
	DIRECTION PSR	Input updated segment value from updated Pavement Index spreadsheet (direction 1)	Post-Project Segment Directional PSR (direction 1)				
	DIE	Input updated segment value from updated Pavement Index spreadsheet (direction 2)	Post-Project Segment Directional PSR (direction 2)				
		Enter in Pavement Needs spreadsheet to update segment level Pavement Need	Post-Project Segment Directional PSR (direction 1)	0	0	0	0
		Enter in Pavement Needs spreadsheet to update segment level Pavement Need	Post-Project Segment Directional PSR (direction 2)	0	0	0	0
		Input current value from performance system	Original Segment % Failure				
	% FAIL	Input value from updated Pavement Index spreadsheet	Post-Project Segment % Failure				
	ш	Enter in Pavement Needs spreadsheet to update segment level Pavement Need	Post-Project Segment % Failure	0.0%	0.0%	0.0%	0.0%
		User entered value from Pavement Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Original Segment Pavement Need				
	Needs	User entered value from Pavement Needs spreadsheet and for use in Performance Effectiveness spreadsheet	Post-Project Segment Pavement Need				
		spreadsheet					

# Performance Area Scoring

	Candidate		Estimated	Pavement					Bridge							Safety			Mobility					Freight				
Candidate Solution #	Solution Name	Milepost Location	Cost (\$ millions)	Existing Need	Post- Solution Need	Raw Score	Risk Factor	Factored Score	Existing Need	Post- Solution Need	Raw Score	Risk Factor	Factored Score	Existing Need	Post- Solution Need	Raw Score	Risk Factor	Factored Score	Existing Need	Post- Solution Need	Raw Score	Risk Facto r	Factored Score	Existing Need	Post- Solution Need	Raw Score	Risk Factor	Factored Score
40.03	Flagstaff Safety	196-200	10.2			0.000		0.000			0.000		0.000	5.296	3.350	1.946	2.75	5.352	1.326	1.213	0.113	3.07	0.347	0.829	0.741	0.088	2.94	0.259
40.04	Lighting	196-202	8.06			0.000		0.000			0.000		0.000	5.296	3.932	1.364	2.75	3.751	1.326	1.289	0.037	3.26	0.121	0.829	0.769	0.060	2.94	0.176
40.05	Ped Improve		2.82			0.000		0.000			0.000		0.000	5.296	1.198	4.098	2.75	11.270	1.326	1.200	0.126	2.52	0.318	0.829	0.663	0.166	2.94	0.488
40.06	Butler TI	198.5- 199.5	4.43			0.000		0.000			0.000		0.000	5.296	3.067	2.229	2.71	6.041	1.326	1.279	0.047	1.91	0.090	0.829	0.753	0.076	2.94	0.223
40.07	East Flagstaff (Composite)	200-207	23.58					0.000					0.000					5.067					0.228					0.446
40.7-A	East Flagstaff	200-202	11.61			0.000		0.000			0.000		0.000	5.296	4.179	1.117	2.70	3.016	1.326	1.296	0.030	2.52	0.076	0.829	0.779	0.050	2.94	0.147
40.7-B	East Flagstaff	202-207	11.97			0.000		0.000			0.000		0.000	4.964	4.150	0.814	2.52	2.051	0.745	0.719	0.026	5.88	0.153	0.982	0.922	0.060	4.99	0.299
40.08	TI Lighting	204.5- 207.5	0.99			0.000		0.000			0.000		0.000	4.964	4.228	0.736	2.47	1.818	0.745	0.722	0.023	5.08	0.117	0.982	0.947	0.035	4.99	0.175
40.09	Winona Safety	207-212	22.21			0.000		0.000			0.000		0.000	4.964	3.072	1.892	2.04	3.860	0.745	0.642	0.103	5.88	0.606	0.982	0.863	0.119	4.99	0.594
40.10	Country Club & Walnut Canyon	201.5- 205.5	8.85			0.000		0.000			0.000		0.000	4.964	4.117	0.847	2.52	2.134	0.745	0.718	0.027	5.68	0.153	0.982	0.920	0.062	4.99	0.309
40.11	Pavement	202-205	12.92	0.603	0.413	0.190	6.25	1.188			0.000		0.000	4.964	4.917	0.047	2.16	0.102	0.745	0.744	0.001	5.42	0.005	0.982	0.980	0.002	4.99	0.010
40.12	Canyon Diablo West Curves	218-220	10.05			0.000		0.000			0.000		0.000	3.164	2.431	0.733	1.72	1.261	1.063	1.026	0.037	4.70	0.174	0.607	0.560	0.047	4.81	0.226
40.13	Canyon Diablo Middle	220-229	13.95			0.000		0.000			0.000		0.000	3.164	2.617	0.547	1.67	0.913	1.063	1.038	0.025	5.97	0.149	0.607	0.573	0.034	4.81	0.164
40.14	Twin Arrows TI	219.5- 220.5	4.43			0.000		0.000			0.000		0.000	3.164	2.375	0.789	1.68	1.326	1.063	1.023	0.040	4.30	0.172	0.607	0.558	0.049	4.81	0.236
40.15	Canyon Diablo East Curves	229-230	5.09			0.000		0.000			0.000		0.000	3.164	2.900	0.264	1.54	0.407	1.063	1.053	0.010	4.30	0.043	0.607	0.590	0.017	4.81	40.15
40.17	East Winslow	258-266	10.86			0.000		0.000			0.000		0.000	2.269	0.837	1.432	1.32	1.890	0.609	0.599	0.010	5.58	0.056	0.182	0.176	0.006	4.87	0.029
40.24	Lupton West	345-351	11.86			0.000		0.000			0.000		0.000	2.292	1.552	0.740	2.41	1.783	0.810	0.807	0.003	3.34	0.010	0.577	0.571	0.006	2.59	0.016
40.25	Lupton East	351-360	4.6			0.000		0.000			0.000		0.000	2.292	1.854	0.438	1.80	0.788	0.810	0.803	0.007	3.66	0.026	0.577	0.573	0.004	2.59	0.010
40.26	Lupton TI's		9.96			0.000		0.000			0.000		0.000	2.292	1.799	0.493	2.46	1.213	0.810	0.804	0.006	2.72	0.016	0.577	0.572	0.005	2.59	0.013

# **Performance Effectiveness Scoring Results**

			Estimated		Risk F	actored Benef	fit Score		Risk Facto	red Emphasis	Area Score	Total Factored			Performance
Candidate Solution #	Candidate Solution Name	Milepost Location	Cost (\$ millions)	Pavement	Bridge	Mobility	Safety	Freight	Safety	Pavement	Bridge	Benefit Score	F <sub>VMT</sub>	F <sub>NPV</sub>	Effectiveness Score
40.03	Flagstaff Safety	196-200	10.2	0.000	0.000	0.347	5.352	0.259	0.037	0.000	0.000	5.99	4.38	15.3	39.4
40.04	Lighting	196-202	8.06	0.000	0.000	0.121	3.751	0.176	0.025	0.000	0.000	4.07	4.78	15.3	37.0
40.05	Ped Improve		2.82	0.000	0.000	0.318	11.270	0.488	0.070	0.000	0.000	12.08	0.61	20.2	53.4
40.06	Butler TI	198.5-199.5	4.43	0.000	0.000	0.090	6.041	0.223	0.028	0.000	0.000	6.38	1.15	20.2	33.5
40.07	East Flagstaff (Composite)	200-207	23.58	0.000	0.000	0.228	5.067	0.446	0.050	0.000	0.000	5.79	3.44	15.3	12.9
40.7-A	East Flagstaff	200-202	11.61	0.000	0.000	0.076	3.016	0.147	0.020	0.000	0.000				
40.7-B	East Flagstaff	202-207	11.97	0.000	0.000	0.153	2.051	0.299	0.030	0.000	0.000				
40.08	TI Lighting	204.5-207.5	0.99	0.000	0.000	0.117	1.818	0.175	0.033	0.000	0.000	2.14	1.16	15.3	38.5
40.09	Winona Safety	207-212	22.21	0.000	0.000	0.606	3.860	0.594	0.055	0.000	0.000	5.11	3.67	15.3	12.9
40.10	Country Club & Walnut Canyon	201.5-205.5	8.85	0.000	0.000	0.153	2.134	0.309	0.030	0.000	0.000	2.63	1.16	20.2	7.0
40.11	Pavement	202-205	12.92	1.188	0.000	0.005	0.102	0.010	0.000	0.056	0.000	1.36	1.65	15.3	2.7
40.12	Canyon Diablo West Curves	218-220	10.05	0.000	0.000	0.174	1.261	0.226	0.041	0.000	0.000	1.70	1.81	15.3	4.7
40.13	Canyon Diablo Middle	220-229	13.95	0.000	0.000	0.149	0.913	0.164	0.028	0.000	0.000	1.25	4.34	15.3	6.0
40.14	Twin Arrows TI	219.5-220.5	4.43	0.000	0.000	0.172	1.326	0.236	0.040	0.000	0.000	1.77	1.01	20.2	8.1
40.15	Canyon Diablo East Curves	229-230	5.09	0.000	0.000	0.043	0.407	40.15	0.012	0.000	0.000	0.54	1.01	15.3	1.6
40.17	East Winslow	258-266	10.86	0.000	0.000	0.056	1.890	0.029	0.026	0.000	0.000	2.00	4.17	15.3	11.7
40.24	Lupton West	345-351	11.86	0.000	0.000	0.010	1.783	0.016	0.040	0.000	0.000	1.85	3.68	15.3	8.8
40.25	Lupton East	351-360	4.6	0.000	0.000	0.026	0.788	0.010	0.022	0.000	0.000	0.85	4.33	15.3	12.2
40.26	Lupton TI's		9.96	0.000	0.000	0.016	1.213	0.013	0.030	0.000	0.000	1.27	1.21	20.2	3.1

**Appendix F: Project Prioritization Scores** 

September 2016

## **Performance Evaluation Risk Factors and Prioritization**

				Pavement Bridge			Safe	ety	Mobi	lity	Frei	ght				Risk Facto	rs					
Candidate Solution #	Candidate Solution Name	Milepost Location	Estimated Cost (\$ millions)	Score	%	Score	%	Score	%	Score	%	Score	%	Total Factored Score	Pavemen t	Bridge	Safety	Mobility	Freight	Weighted Risk Factor	Segment Need	Prioritization Score
40.03	Flagstaff Safety	196-200	10.2	0.000	0.0%	0.000	0.0%	5.389	89.9%	0.347	5.8%	0.259	4.3%	5.994	1.14	1.51	1.78	1.36	1.36	1.738	1.23	84
40.04	Lighting	196-202	8.06	0.000	0.0%	0.000	0.0%	3.776	92.7%	0.121	3.0%	0.176	4.3%	4.073	1.14	1.51	1.78	1.36	1.36	1.749	1.23	80
40.05	Ped Safety	0	2.82	0.000	0.0%	0.000	0.0%	11.340	93.4%	0.318	2.6%	0.488	4.0%	12.145	1.14	1.51	1.78	1.36	1.36	1.752	1.23	115
40.06	Butler TI	198.5-199.5	4.43	0.000	0.0%	0.000	0.0%	6.069	95.1%	0.090	1.4%	0.223	3.5%	6.382	1.14	1.51	1.78	1.36	1.36	1.759	1.23	73
40.07	East Flagstaff	200-207	23.58	0.000	0.0%	0.000	0.0%	5.118	88.3%	0.228	3.9%	0.446	7.7%	5.793	1.14	1.51	1.78	1.36	1.36	1.718	1.39	31
40.08	TI Lighting	204.5-207.5	0.99	0.000	0.0%	0.000	0.0%	1.851	86.4%	0.117	5.5%	0.175	8.2%	2.143	1.14	1.51	1.78	1.36	1.36	1.723	1.46	97
40.09	Winona Safety	207-212	22.21	0.000	0.0%	0.000	0.0%	3.915	76.5%	0.606	11.8%	0.594	11.6%	5.114	1.14	1.51	1.78	1.36	1.36	1.681	1.46	32
40.10	Country Club & Walnut Canyon	201.5-205.5	8.85	0.000	0.0%	0.000	0.0%	2.165	82.4%	0.153	5.8%	0.309	11.8%	2.627	1.14	1.51	1.78	1.36	1.36	1.706	1.46	17
40.11	Pavement	202-205	12.92	1.244	91.4%	0.000	0.0%	0.102	7.5%	0.005	0.4%	0.010	0.7%	1.361	1.14	1.51	1.78	1.36	1.36	1.190	1.46	5
40.12	Canyon Diablo West Curves	218-220	10.05	0.000	0.0%	0.000	0.0%	1.302	76.5%	0.174	10.2%	0.226	13.3%	1.702	1.14	1.51	1.78	1.36	1.36	1.681	1.46	12
40.13	Canyon Diablo Middle	220-229	13.95	0.000	0.0%	0.000	0.0%	0.941	75.1%	0.149	11.9%	0.164	13.0%	1.254	1.14	1.51	1.78	1.36	1.36	1.675	1.46	15
40.14	Twin Arrows TI	219.5-220.5	4.43	0.000	0.0%	0.000	0.0%	1.366	77.0%	0.172	9.7%	0.236	13.3%	1.774	1.14	1.51	1.78	1.36	1.36	1.683	1.46	20
40.15	Canyon Diablo East Curves	229-230	5.09	0.000	0.0%	0.000	0.0%	0.418	77.0%	0.043	7.9%	0.082	15.1%	0.543	1.14	1.51	1.78	1.36	1.36	1.683	1.46	4
40.17	East Winslow	258-266	10.86	0.000	0.0%	0.000	0.0%	1.916	95.8%	0.056	2.8%	0.029	1.5%	2.001	1.14	1.51	1.78	1.36	1.36	1.762	1.15	24
40.24	Lupton West	345-351	11.86	0.000	0.0%	0.000	0.0%	1.823	98.6%	0.010	0.5%	0.016	0.8%	1.849	1.14	1.51	1.78	1.36	1.36	1.774	1.46	23
40.25	Lupton East	351-360	4.6	0.000	0.0%	0.000	0.0%	0.810	95.7%	0.026	3.0%	0.010	1.2%	0.846	1.14	1.51	1.78	1.36	1.36	1.762	1.46	31
40.26	Lupton TI's	0	9.96	0.000	0.0%	0.000	0.0%	1.242	97.7%	0.016	1.3%	0.013	1.0%	1.272	1.14	1.51	1.78	1.36	1.36	1.770	1.46	8